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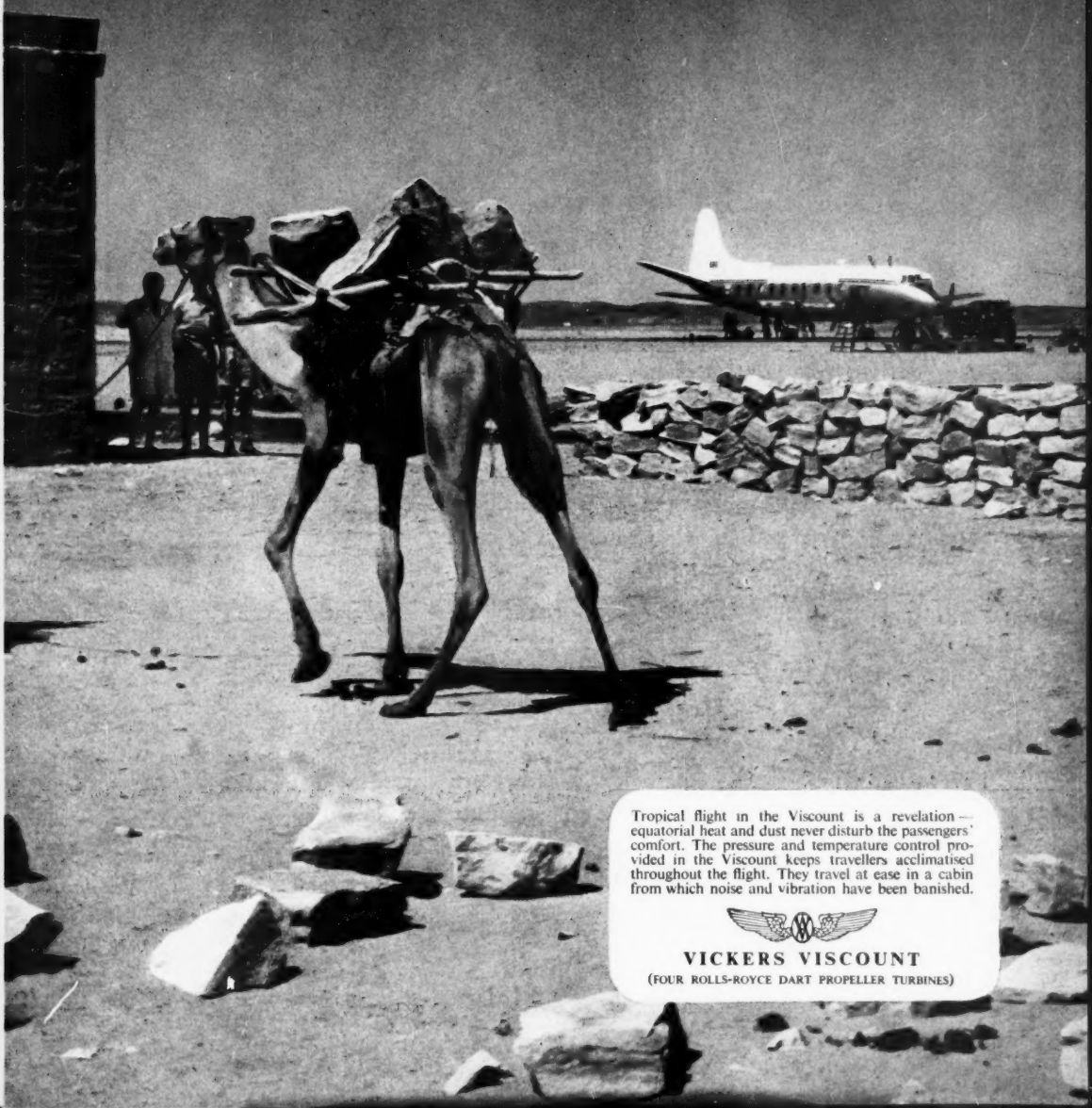

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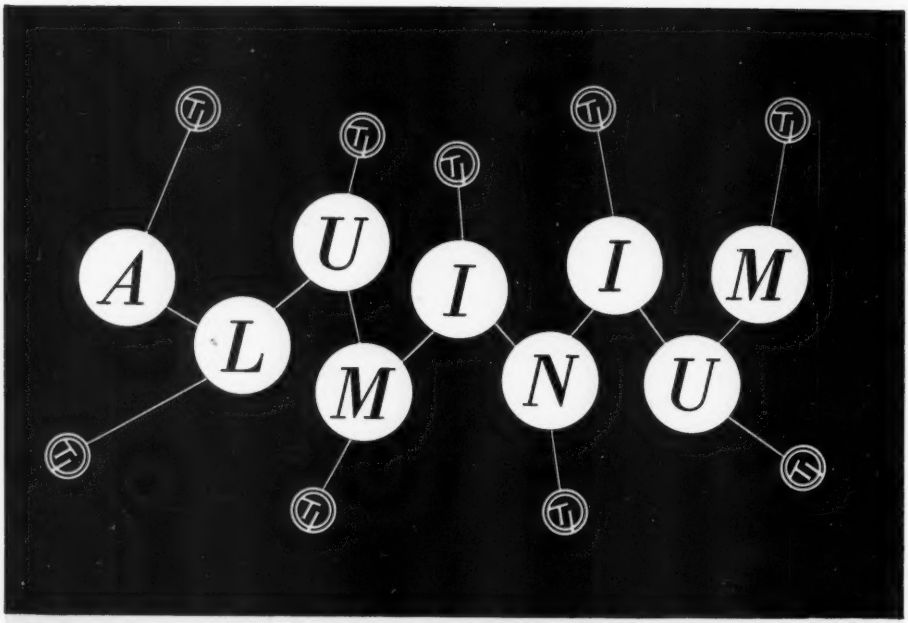

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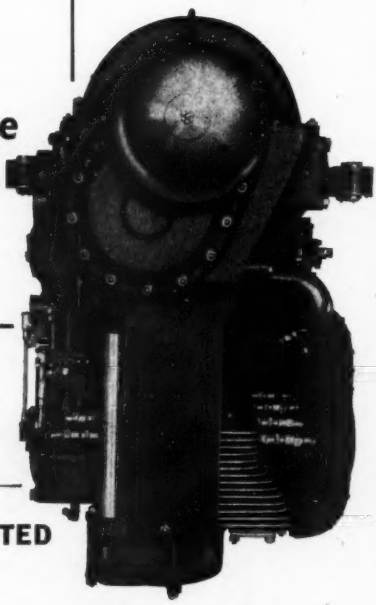

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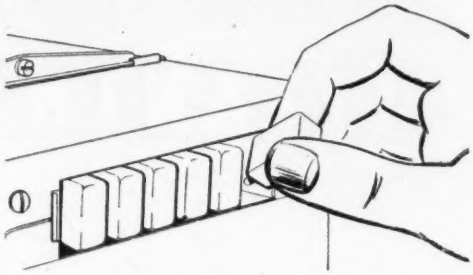

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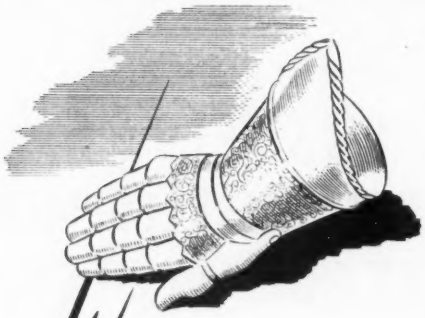

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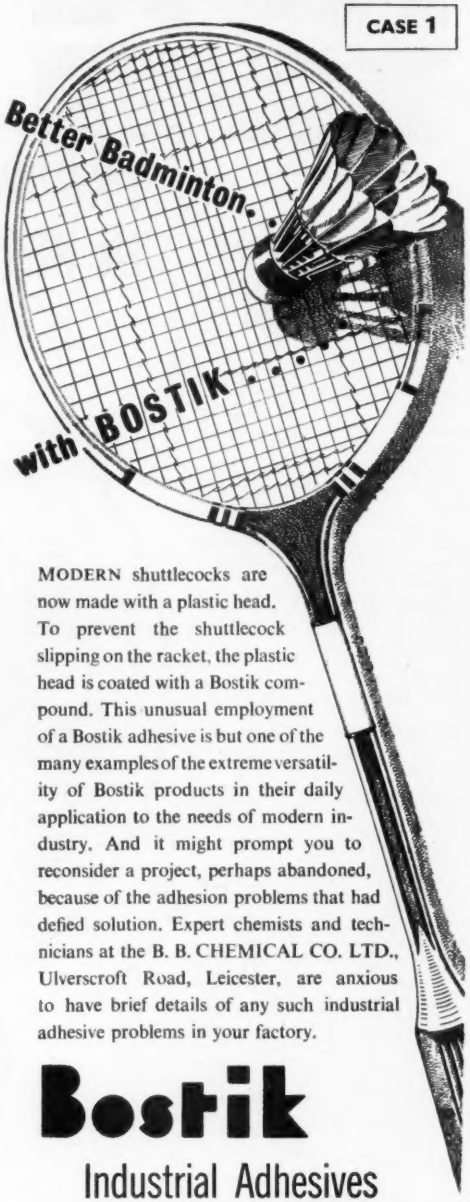

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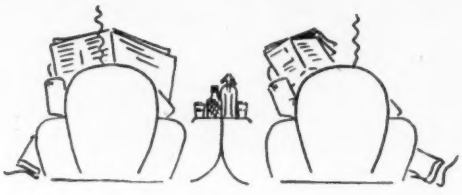

"My word,—that's clever"——"What is old man?"
"This passenger comfort in the air business"——"Is it?"
"Well, if flying over the north pole in a lounge suit can be called clever"——
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"Oh, there are old man"——
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Blissful Thinking

LAST week we remarked on several matters raised during the recent civil aviation debate in the House of Commons, a full summary of which appears on pages 404-408 of this issue. One aspect of the discussions still calls for comment—namely, that whereas certain well-informed speakers ably marshalled their facts to make speeches that were both penetrating and constructive, others displayed singular ignorance.

There was, for example, the attitude shown by some Members towards the ordering and development of new civil aircraft. It is true that once upon a time it was possible for Sir Alan Cobham to foresee a requirement, state his readiness to buy two multi-passenger aircraft from Airspeeds, and to take delivery of the first, after it had completed its four-day tests at Martlesham, only ten months later. And in those days, too (as Lord Malcolm Douglas-Hamilton mentioned in the debate), a motor-coach proprietor—Edward Hillman—was able to draw a picture and say, "I want an airliner like this," whereupon the de Havilland Dragon materialised with almost magical speed.

But today—as everybody, including M.P.s, should surely know—conditions are very different. Air transport has not developed exactly along the lines foreseen in 1945, nor have aircraft requirements turned out entirely as expected. Moreover, it now takes, at the least, five years to design, build, test, develop, produce and deliver for service a given type of large civil aircraft. It is therefore unreasonable, during a period of unprecedented and largely unpredictable airline development, to expect any man or committee to foresee exactly the characteristics required of each new generation of aircraft. Mistakes, indeed, form the foundations of the path of progress.

How nice it would be for operators if constructors such as de Havillands could have produced a shop-windowful of Comets, wheeled one out for Sir Miles Thomas to test and, upon receiving his approval, wrap up a couple of dozen for Carter Paterson to deliver next morning! Yet at least one statement in the debate seemed to suggest a belief in such improbabilities.

If every operator witheld orders until he could buy his equipment off the peg there would be no new aircraft. To have faith in the British aircraft industry, as shown by B.O.A.C's action in ordering the first jet airliners at an early stage, is the right and courageous way to meet today's changed conditions.

Naval Power

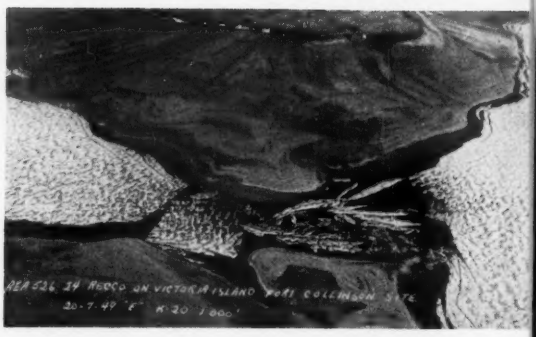
JUST over half a century ago the first British warships to be powered by steam turbines—"torpedo boats" named *Viper* and *Cobra*—were launched. To-day, the first airscrew-driving turbines to be ordered in quantity for British Naval aircraft are in production and, by a happy coincidence, bear the names Mamba and Python. Both are Armstrong Siddeley products. The Mamba—or, more correctly, the Double Mamba—powers the Fairey 17 anti-submarine three-seater, while the Python is installed in the Westland Wyvern single-seater strike fighter.

It was with the Double Mamba particularly that Mr. D. L. Hollis Williams, chief engineer of the Fairey company, was concerned in his recent lecture before the Royal Aeronautical Society (see pages 399-403); more specifically he dealt with its relationship to the Fairey 17, for the design of which he himself was very largely responsible. The combination is one of exceptional interest in that the "17's" power plant was truly tailor-made, and had it failed to appear on time no substitute could have been found without drastic redesign of the airframe forward of the front spar. As things turned out, the union has proved a remarkably happy one. Though Mr. Hollis Williams confesses that, had a piston engine of just the right size been available, the Fairey company would probably have been conservative enough to favour it, the Double Mamba is now the standard power plant for a key aircraft in our vast rearmament programme.

Whatever the engine requirements of the Royal Navy in the immediate future, the industry appears well able to meet them. It is to be hoped, however, that suitable power sources will be ready for the large-load-carrying, all-weather helicopter which Mr. Hollis Williams believes might eventually supplant the fixed-wing anti-submarine aircraft.

AIR-SURVEYING ARCTIC CANADA

Navigational and Photographic Problems in High Latitudes: The R.C.A.F. at Work



This R.C.A.F. ice-floe picture was taken at Victoria Island in mid-July.

PROBABLY the most formidable air-survey task ever undertaken—the mapping of Northern Canada—is due to be completed this summer. Started on a small scale soon after the First World War, it gained momentum until, in 1948, some 911,000 square miles of territory had been photographed and mapped. In a few weeks' time the work will be resumed, for the R.C.A.F. detachments go into the field as soon as the snow has gone from the southern areas and ice on the lakes has started to break up, normally over by the middle of October.

Writing in *Arctic*, the journal of the Arctic Institute of North America, W/C R. I. Thomas, O.C. No. 22 Photo Wing, R.C.A.F., explains that the preparation for any air-survey operation in the north must begin approximately 18 months ahead. It is necessary to lay in petrol and oil a year ahead so that it is available when photography can start. Once a cache has been assured at a base the detailed planning gets under way during autumn and winter.

The scale of the work calls for flexibility within the organization of the squadrons. This is attained by sub-dividing each into smaller, self-sufficient formations. The ground crews include engine, airframe, radio, electrical, instrument and safety equipment fitters, in addition to cooks and mess orderlies. Aircrews consist of pilots, navigators, radio officers and camera operators. Each detachment must take with it spares for its aircraft, ground handling and servicing equipment, rations, and personal clothing. The weight of equipment for a Dakota detachment of three aircraft and forty-five personnel is approximately 75,000 lb, which gives some idea of the effort involved.

This local character visited the R.C.A.F. camp at Coppermine to refill his petrol lighter. In the background is a supply-carrying Norseman.

By 1949 the supply problem had reached such proportions that the original post-war photographic squadron, No. 413, was converted into a transport unit, using four Dakotas, six Cansos and five Norseman aircraft.

Many of the earlier problems encountered have now been eliminated by using long-range aircraft and by the availability of northern bases. The problem that still retains a formidable stature and determines the area that can be covered in a season is the weather. The winter (continues W/C. Thomas) is followed closely northward; we work on the heels of the melting snow and ice. In some areas convection cloud forms as the land warms, and it is not unusual to find only a few days during the entire season when photography is possible. To obtain coverage of these areas the R.C.A.F. must be on the spot and ready to fly 10 to 15 hours a day while conditions remain good, a feat made possible by nearly continuous daylight during the summer months.

To reduce the weather-check flying and to allow available aircraft to be concentrated on an area where weather conditions are suitable for photography, a system of control has been worked out with the Meteorological Division. Certain centres are chosen to supply meteorological information to the survey squadrons and, where possible, the Department of Transport assigns an extra forecaster at these centres who passes special forecasts to the detachments. In some cases quite extensive communications channels have had to be set up. In 1948, for instance, when operations were being carried out in Baffin Island, meteorological data from the north-western Arctic was picked up by R.C.A.F. field units from the Department of Transport at Coral Harbour and then passed to Goose Bay through the R.C.A.F. unit at Fort Chimo. Had normal Department of Transport channels been used the delay would have been too great for the data to be of use in the survey operations.

Shoran, a recent introduction in the survey field, came into operation in 1950. It involves using airborne radar equipment in conjunction with ground radar beacons spaced several hundred miles apart, and allows photographs of the area concerned to be positioned accurately.

In addition, it is hoped that Shoran can be used to establish accurate fixes in the north. To do this the photo procedure is reversed. Two ground stations at known positions are used to fix the position of the aircraft, whereas in applying Shoran to survey the aircraft flies at a known height above sea level and measures the "slant" distance to the two ground stations. From the results the distances between the ground stations is calculated. In 1949 measurement was begun of a large network of Shoran stations stretching from the Winnipeg area to Fort Vermilion in Alberta, a distance of approximately 1,200 miles. This programme was completed in 1950, and the soundness of the method proved. Accuracy in the order of 1/58,000 has been achieved.

Tri-camera photography is undertaken exclusively by No.

Yellowknife is typical of the "larger" towns in the survey area.

Uninviting terrain—and more July ice—photographed on Victoria Island.

408 Squadron, consisting of eight long-range Lancaster 10 aircraft, each equipped with three Fairchild F.224 cameras precision-mounted in a single mount. The cameras are tied-in to each other to within 10 seconds of arc, and each camera is jig-drilled to be interchangeable without disturbing the calibration. In addition, these aircraft carry Williamson Ordnance Survey cameras for vertical coverage.

Vertical photography is primarily allotted to No. 414 Squadron, which is entirely committed to this work, although aircraft of No. 408 may take vertical photographs when tri-camera areas are not available. No. 414 is equipped with 14 Dakota Mk 6 aircraft with long-range cabin tanks and a cabin well for a Williamson Ordnance Survey camera.

Whenever possible tri-camera coverage is obtained before vertical photography is attempted. Although this involves an additional year's delay in producing the maps to the scale of four miles to the inch, it means that much-improved maps become available earlier for use by commercial firms wishing to explore almost virgin territory.

The normal day for a photo detachment starts at about 3 a.m., when the duty crew checks the final weather forecast and prepares to make a flight to check actual weather. The first aircraft are usually airborne by 5 a.m.; if conditions are clear, the others are called into the air by radio.

On an average flight the aircraft is climbed gradually to approximately 10,000ft and the search for clear areas continued at that altitude. In this way a great deal of oxygen is conserved. If and when a clear area is sighted the aircraft climbs to 20,000ft and the crew make final preparations for the photo-line flying. Cameras are given a short test run, the solar navigator (an adaptation of an astro-compass) is set up, and the aircraft is trimmed carefully for straight and level flight. The trips to the operational area are done on dead-reckoning navigation, since existing maps are very inaccurate. A three-course wind is usually found before starting down the first line to give the navigator a course to fly and to help him in checking the end of a line.

Once the area is reached the navigator takes over and directs the pilot to the beginning of the first line to be attempted. Turn onto line is done about 15 to 20 miles back from the start of the line shown on the map. The drift is checked carefully and the solar navigator started. Meanwhile the camera operator checks the interval and drift on his view-finder and levels the camera. As the start of the line approaches the navigator gives the order to start the camera. On the line the navigator is busy checking drift every ten minutes at least, and making new settings on the solar navigator. In between times he is trying to pick up pinpoints and also sketch in on his flight-line map any details which may help him on his next line.

The second pilot assists the navigator in map reading while the first pilot is occupied in maintaining the required heights within ± 50ft and holding course to within less than one degree. This calls for intense concentration and not all pilots can measure up to it, especially when flights may last as long as ten hours.

One of the major problems in the north is maintaining direction. The best magnetic compass becomes erratic in higher latitudes and the vacuum-driven gyros do not stand up very well. Even gyros corrected for the mean latitude of the operations may go unserviceable and precess excessively after a very short time. The solar navigator is used to direct the pilot for straight-line flying, and the astro compass is used to supply settings for the gyro instruments.

Another major problem is servicing the aircraft in the more isolated bases. No hangars or other permanent facilities are available at such places as Norman Wells, Yellowknife, or Coral Harbour, and the work must be done in the open—in rain, snow, or sun as the case may be. Dust is another constant torment to the hard-worked ground crew. Refuelling has to be done from barrels, and even with portable electric- or petrol-operated pumps this is a long process. Often the caches are established some distance from the nearest taxi area and the barrels must be manhandled to the vicinity of the aircraft. In spite of the limited facilities remarkable records of serviceability are achieved. One squadron maintained 100 per cent serviceability on twelve aircraft for approximately a month, during which they flew 1,700 hours and photograped 120,000 square miles.

Film exposed in the field is shipped to No. 1 Photo Establishment at Rockcliffe for processing. Possessing one of the world's finest and most modern aerial photographic laboratories, this establishment plays a vital part in the overall programme. The exposed roll films are sent in with a full report listing the area covered, weather conditions at the time of exposure, height and speed of aircraft, and other details. The film is put through continuous processing machines for development, and is turned out at the rate of five feet a minute. The negatives are then placed on annotating tables with glass tops lit from underneath. Here the film is given an initial check for accuracy and quality, and each negative is numbered to allow instant identification. Possible gaps in the area being covered, caused by camera failures or lack of forward overlap, are spotted at this stage.

The negatives are then printed and laid out in a mosaic. The mosaic shows whether any lateral gaps exist as a result of errors in navigation. The lay-down, as this mosaic is called, is then photographed and, if there are gaps, the detachment which flew the lines is notified and prints of the lay-down are sent out to be used in doing the re-fly.

The R.C.A.F. is not responsible for map making. The finished prints are turned over to the Department of Mines and Technical Surveys or the Army Survey Establishment which are responsible for the compilation of maps.

The survey programme is primarily for the compilation and correction of maps, but the photographs serve many other purposes. They have proved to be useful in mineral exploration, water-power development, forest and agricultural surveys, and town-planning investigations and are made available to both Government agencies and commercial organizations.

FROM ALL QUARTERS

PROGRESS AT WOOMERA

WELCOME news of progress was given last week by Air Chief Marshal Sir Alec Coryton, Chief Executive, Guided Weapons, Ministry of Supply. He has recently returned from visits to the Woomera rocket range in Australia and its controlling establishment at Salisbury, and to America to see similar work there. In relation to the expense and effort devoted to guided missiles, said Sir Alec, progress had been satisfactory.

Woomera range, some 350 miles north of Adelaide, is capable of almost unlimited extension, first for 1,200 miles over land then over the ocean. Large and small rockets have already been fired and, as readers will know, a small Australian pilotless type of aircraft is now being test-flown—at present with a pilot. What Sir Alec referred to as "test vehicles" were being developed to carry and test in full scale the component units—propulsion, control, electronic and the V.T. proximity fuses, of future missiles. Through a subsidiary company in Australia—Fairey Clyde—the Fairey company is already testing home-produced components.

For initial testing there are two limited ranges in this country; full scale and series testing will take place in Australia. Costs of Woomera and its associated factory at Salisbury are shared with Australia, and Sir Alec Coryton said that great credit was due to the Australians for their enthusiasm and progress.

Chief superintendent at Salisbury, which controls Woomera range, is Mr. H. C. Pritchard, who is on attachment for a period of two years from the R.A.E. Under Sir Alec in this country is the Director of Guided Weapons, Research and Development, Mr. G. W. H. Gardner.

CANBERRA P.R.3

THE existence of a photographic reconnaissance version of the English Electric Canberra, designated Canberra P.R.3, may now be disclosed. As in the marks B.1 and B.2, the turbojets are Rolls-Royce Avons.

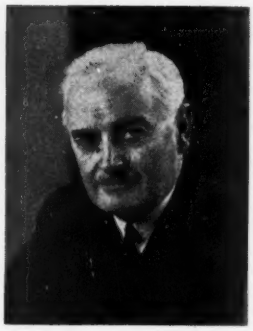
ON SHOW IN PARIS

PRODUCTS of several British manufacturers will, as usual, be seen in the Paris Show—to be held at the Grand Palais and at Le Bourget from June 15th to July 1st. A recent list of exhibitors includes the following: Armstrong Siddeley; Blackburn and General Aircraft; Bristol Aeroplane Company; Dowty Equipment; Hawker Siddeley Group; H. M. Hobson; Lodge Plugs; Ministry of Civil Aviation; Rolls-Royce; Vickers-Armstrongs.

INTERPLANETARY RADAR

VISITORS to the London South Bank site during the Festival of Britain will be able to transmit radar impulses to the moon and observe their reflection. The 30ft-diameter aerial for the purpose was manufactured by Blackburn and General Aircraft in light-alloy tubing; it was recently transported to the site for erection on the famous shot tower. Rotation of the aerial will be by remote control from the Dome of Discovery.

Another aeronautical contribution to the Festival (in addition to the list of South-Bank exhibits mentioned in *Flight* of March 23rd) comes from Rolls-Royce, Ltd., who are providing a Dart turboprop for exhibition in the Festival ship *Campania*.



A DERBY BROADCAST: Entitled "The Flight of the Merlin," a Midland Regional broadcast last Monday featured the famous Rolls-Royce engine. R.-R. officials who took part were Mr. A. G. Elliot, C.B.E., director and chief engineer (seen here); Mr. A. C. Lovesey, O.B.E., development engineer; and Capt. R. T. Shepherd, O.B.E., chief test pilot. Mr. John Reid (Rotol, Ltd.,) and G/C. Donaldson, D.S.O., A.F.C., and W/C. Tait, D.S.O., D.F.C., also spoke.

GLOBEMASTER LOST

ONE of the greatest air-sea rescue operations ever undertaken followed the loss, on March 23rd, of a Douglas C-124 Globemaster II flying from Limestone, Maine, to Lakenheath, Suffolk. Fifty-three members of the U.S.A.F. were aboard, including Brig. Gen. P. T. Cullen, a reconnaissance specialist. The search, which continued unsuccessfully until March 31st, involved over 100 aircraft and several surface vessels, including the carrier *Coral Sea*. The possibility of an explosion in flight was suggested when numerous small, charred portions of the missing aircraft were found some 500-600 miles south-west of Shannon. Photographs of two of the search aircraft engaged appear on p. 391.

FEBRUARY AIRCRAFT EXPORTS

EXPORTS of British aircraft, engines and accessories (excluding magnetos and tyres) during February totalled in value £4,284,218. This is a considerable increase in comparison with the January figure of £3,516,441.

February imports, at £837,899, were fewer by £165,530 than the January total. The usual breakdown of the values into totals for items is not yet available.

Annual totals for the three years to the end of 1950 were: 1948, £26,004,784; 1949, £34,215,177; 1950, £34,275,423. As these figures include engines and accessories, and because prices of individual aircraft differ widely, the sums bear little direct relation to the numbers of complete aircraft exported. These numbers were 1,099 in 1948, 1,175 in 1949 and 852 in 1950.

MINISTER SEES FOR HIMSELF

VISITS to two important branches of the aircraft industry were made last week by the Minister of Supply, Mr. G. R. Strauss. On March 28th, he saw two sides of Hawker Siddeley activity in Gloucestershire: the A. W. Hawksley works at Brockworth (now building aluminium houses but turning over to Avon production shortly) and the Hucclecote and Moreton Valence sections of the Gloster Aircraft Company. At Hucclecote, Mr. Strauss surveyed the production of Meteors—Mks 7, 8, 9 and 10, for training, fighting and reconnaissance (Mk 11 night fighters, it will be recalled, are produced by Armstrong Whitworth).

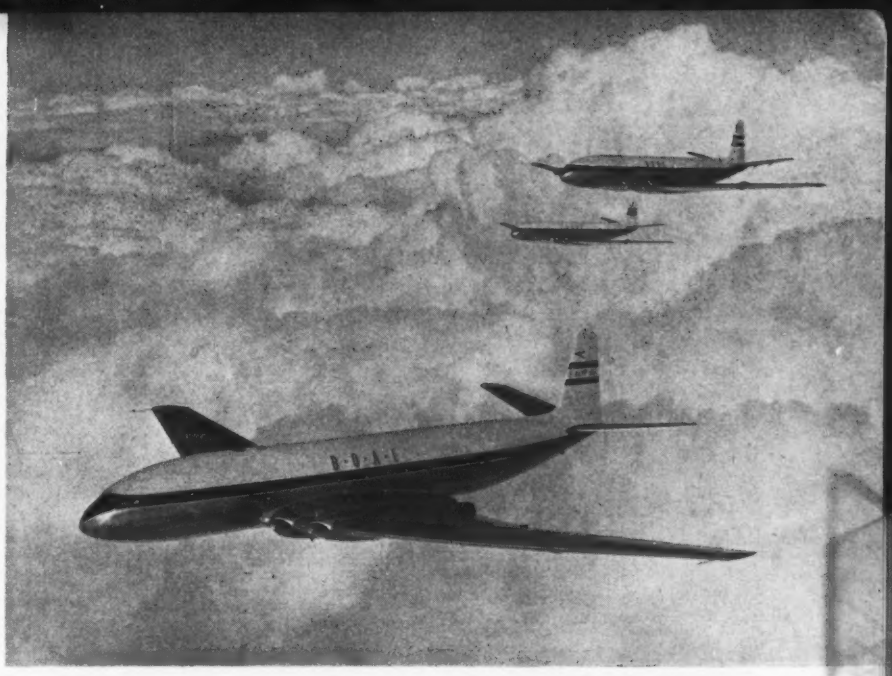
Nearly 100 completed Meteors were in evidence at the Gloster airfield, Moreton Valence, where Mr. Strauss was given his first sample of Meteoric speed by S/L. Jim Cooksey, chief production test pilot and holder of the 1,000-km closed-circuit record. Airborne in a Meteor 7 for 15 minutes, Mr. Strauss was suitably thrilled and impressed by the experience.

On the following day, the Minister inspected both aircraft and engine divisions of the Bristol Aeroplane Company at Filton. He saw work in progress on the second Brabazon, the Bristol 171 and 173 helicopters and the Type 175 airliner. Referring to the Brabazon II, Mr. Strauss said that the Government were "entirely happy" about the project. Considerable knowledge was being gained, but no prophecy could be made at present as to the eventual use of the Brabazon.

Earlier, at Gloucester, Mr. Strauss had spoken of the effects of the rearmament programme on the aircraft industry. Production, responding to the large orders now being placed, would mount in a steep curve in 1952-53. Within the engineering industry, some 500,000 people would be employed on rearmament.

MINISTERIAL METEOR: With S/L. Jim Cooksey at the controls, Mr. G. R. Strauss, the Minister of Supply, flew at 500 knots in a Meteor 7 during a 15-minute flight from Moreton Valence last week. Other aspects of the Minister's recent visits to aircraft concerns, reported on this page, are illustrated on pp. 390 and 391.

THE COMETS ARE COMING



Airborne together, the three completed Comets provide pictorial expression of de Havilland's unmatched progress in the jet-airliner field. In the foreground is G-ALYP, the first production Comet (seen now with smaller wing "fences") destined for B.O.A.C.'s scheduled services; the two prototypes, VG and ZK, cruise discreetly in the background. ZK, incidentally, was handed over to the Corporation at London Airport last Monday. On loan from the Ministry of Supply, it will be based at London Airport for crew familiarization and to give B.O.A.C. a "preview" of handling and maintenance technique. Normal proving flights and training will follow later. Its interior is not fully furnished or soundproofed and it has an orthodox undercarriage: the B.O.A.C. Comets will have four-wheel bogies.

CONTRACT FOR THE LEONIDES

FOLLOWING the selection of the Percival P.56 as the new R.A.F. basic trainer, Alvis, Ltd., announce that they have received a sizable contract from the Ministry of Supply for Leonides engines for these aircraft. Mr. John J. Parks, managing director of Alvis, Ltd., was to make an official statement regarding this contract on April 5th.

There are now nine separate aircraft types in this country which fly on Leonides power, and six variations of the Leonides have been developed and tested, of which some are horizontally-mounted units for helicopters. It may be presumed that, in view of helicopter requirements currently under discussion, the Alvis Company is also examining the possibilities of meeting a need for a radial of rather higher power than the Leonides.

THE AIRWAYS SYSTEM

THE final stage—Phase III—of the British "National Airways" system will be brought into effect in the near future; it will be introduced in two stages, the first coming into operation on April 12th and the second on August 1st.

With the introduction of Phase III the Liverpool and Manchester Control Zones will be merged into one and the Prestwick and Renfrew Zones replaced by a single "Scottish Control Zone".

By August 1st, therefore, the whole network of Britain's airways, which was begun last August, will have been completed, and the multi-carrier system of V.H.F. R/T which has been installed throughout the country will enable airline pilots on any lane of the airways to be constantly in touch with the appropriate ground-control organizations.

A description of the airways pattern after Phase II had been brought into operation appeared in *Flight* of February 15th.

I.F.A.L.P.A. CONFERENCE

THE sixth conference of the International Federation of Air Line Pilots' Associations is to be held in Amsterdam from April 9th to 13th, at the invitation of the Dutch Air Line Pilots' Association and the K.L.M. International Pilots' Association. Founded in London in April, 1948, the Federation numbers among its members some 19 separate associations.

Among the items on the agenda of the conference, which will be held under the chairmanship of Capt. W. L. Vickerstaff, I.F.A.L.P.A.'s president, are the problems of pilot-operated R/T. systems, noise and lighting conditions in control cabins, the legal status of aircraft captains and the question of pilots operating when under mental stress. Additional subjects to be discussed are the carriage of excess fuel, the effects of pressurization on crews, flying hours and fatigue, the civil liability of pilots, uncontrolled flights in civil air-lanes and the effects on air-traffic control problems of airports lying in close proximity to one another.

The British delegates will be Capt. C. G. Klimcke (B.E.A.), Capt. B. C. Frost (B.O.A.C.), and Capt. F. Ormonroyd (B.E.A.).

METEOR 8 ON THE AIR

BY recording the R/T. comments of the pilot during climb and descent to and from 30,000ft, the B.B.C. provided listeners last week with a graphic impression of the performance of the Meteor 8. The recording was made during the Minister of Supply's visit to the Gloster Aircraft Company last week, and was broadcast on March 28th and April 1st. The voice of production test pilot Geoff Worral was heard very clearly, with only a faint rush of air as background, as he ticked off the altimeter-readings to 30,000ft—reached in less than six minutes. His casual, matter-of-fact remarks during a very rapid descent and pull-out belied the discomfort he was undoubtedly feeling from negative-g effects.

ARMY WIN AT TWICKENHAM

SOUND tackling in defence and determined attack enabled the Army Rugby fifteen to beat the R.A.F. by 14 points to nil at Twickenham last Saturday. The Army's two tries and a goal came in quick succession in the second half. Previously a dropped goal had put them three points up at half time. A fuller report of the match will be given next week.

This was the last match in the season's Inter-Service Tournament, which has been won by the Royal Navy. Other results were: Royal Navy v. R.A.F., 6pt-5 pt; Royal Navy v. Army, 11 pt.-nil. The R.A.F.'s last victory over the Army was in 1947 by 8 pt.-to nil. Last year the Army won, 11 pt.-3 pt.

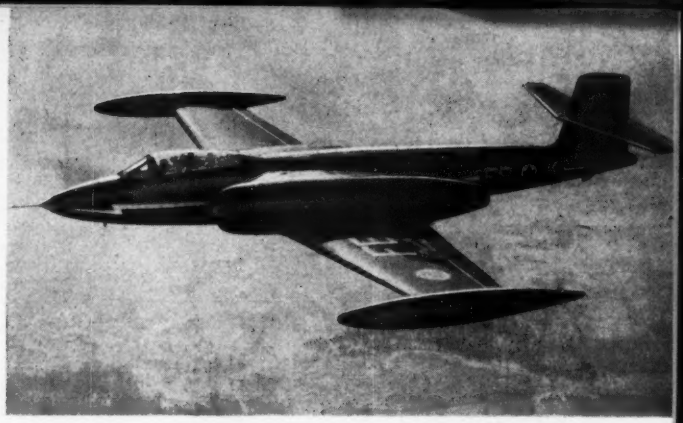
HIGHER LANDING-CARD CHARGES

THE M.C.A. has announced several modifications to the Royal Aero Club's annual landing-card scheme for private and club-owned aircraft using State-controlled airfields. The present arrangements, whereby landing cards, costing £5 each and valid for 12 months, are issued for aircraft not exceeding 6,000 lb a.u.w., have been cancelled with effect from April 1st, and the scale of detailed charges below is now in force.

For club machines not exceeding 4,000 lb a.u.w. cards are available at a cost of £5 per annum. Privately-owned aircraft have been divided into two categories; the card for those not exceeding 2,600 lb a.u.w. now costs £7 10s. and for those up to 4,000 lb a.u.w. £10.

The new charges apply to all cards issued after March 31st. Henceforth the Royal Aero Club scheme is inapplicable to aircraft of more than 4,000 lb a.u.w., for which—on expiry of current landing cards—normal fees at State-owned airfields will apply.

HERE AND THERE



IN TRANSATLANTIC TRIM: Tip-tanked for longer endurance, as seen here, an Avon-powered Avro Canada Canuck will shortly fly the Atlantic. The prospect is discussed below.

Turkish Jets

FIVE Turkish airfields are being enlarged in preparation for the delivery of 100 American jet fighters for the Turkish Air Force, following a recent visit to Turkey by the U.S. Secretary for Air, Mr. Finletter.

Jetliner's Designer Honoured

FIRST non-American to win the award, Mr. James Floyd is to be presented with the Wright Brothers Medal of the American Society of Automotive Engineers. As chief design engineer (transport) of Avro Canada, Mr. Floyd was responsible for the Jetliner Derwent-powered airliner.

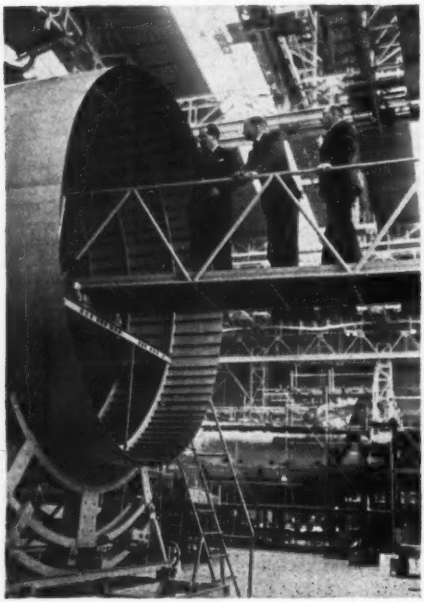
170-ton Jet Bomber

EIGHT turbojets, mounted in four pods beneath the wings, will power an experimental version of the Convair B-36, now under construction, which may fly later this year. Designed to attain 550 m.p.h. at 55,000ft, the all-jet B-36 will have 35-deg sweep-back of wings and tailplane. The present B-36D, with six piston engines and four jets, reaches 435 m.p.h. at altitude.

NAVAL AVIATION

A FORTNIGHT hence—on Friday, April 20th—an exceptionally interesting and important number of *Flight* will appear. Devoted to British Naval Aviation, this enlarged issue—which will constitute a valuable work of reference—will contain both historical and topical articles on its subject, together with a pictorial feature unique of its kind. The Admiralty has co-operated closely in the preparation of much of the material.

It may be recalled that the demand for last year's Royal Air Force Number—to which the Naval Aviation Number will be complementary—was so great that many would-be readers were disappointed. The moral is obvious: orders should be placed with newsagents immediately.



SECTIONED VIEW: Inspecting a portion of the fuselage, Mr. G. R. Strauss (left) gives scale to this section of the Bristol 175 turboprop airliner for B.O.A.C. The Minister of Supply's companions in this tour of the Brabazon assembly hall, during his visit to Filton last week, were Mr. A. E. Russell, Bristol's chief designer, and Mr. F. J. Chard, Brabazon production manager.

Largest Trainer

WITH their high speeds, critical fuel consumption and extensive use of radar, jet bombers demand extreme proficiency in a small crew. The 600-m.p.h. Boeing B-47 Stratojet, for example, will be operated by a three-man team, consisting of pilot, gunner and a combined navigator/bombardier / radar - operator. Special steps are being taken by the U.S.A.F. to train the versatile triple-duty navigators, who are expected to graduate from the new Bombing School at Mather A.F.B., California, at the rate of 650 a year.

Among the school's aircraft is the world's largest trainer, the Boeing TB-50D, the first of which was recently delivered. Basically a B-50 bomber, the TB-50D has normal crew positions plus stations for four students with two instructors. Navigational and bomb-aiming instruction is given in the forward compartment; extra radar stations are in the rear fuselage. Gun turrets have been removed and the rear bomb-bay sealed to house extra equipment.

Newbury Protest

COMMONS at Greenham and Cookham, near Newbury, were recently requisitioned by the Air Ministry as the site for a new airfield, to be used initially as a base for U.S.A.F. heavy bombers. Signatures are now being obtained in the district for a petition to Parliament that the scheme be abandoned. Residents emphasize that the petition is not a protest against the Americans, but against the action of the Air Ministry.

Canuck's Record Attempt

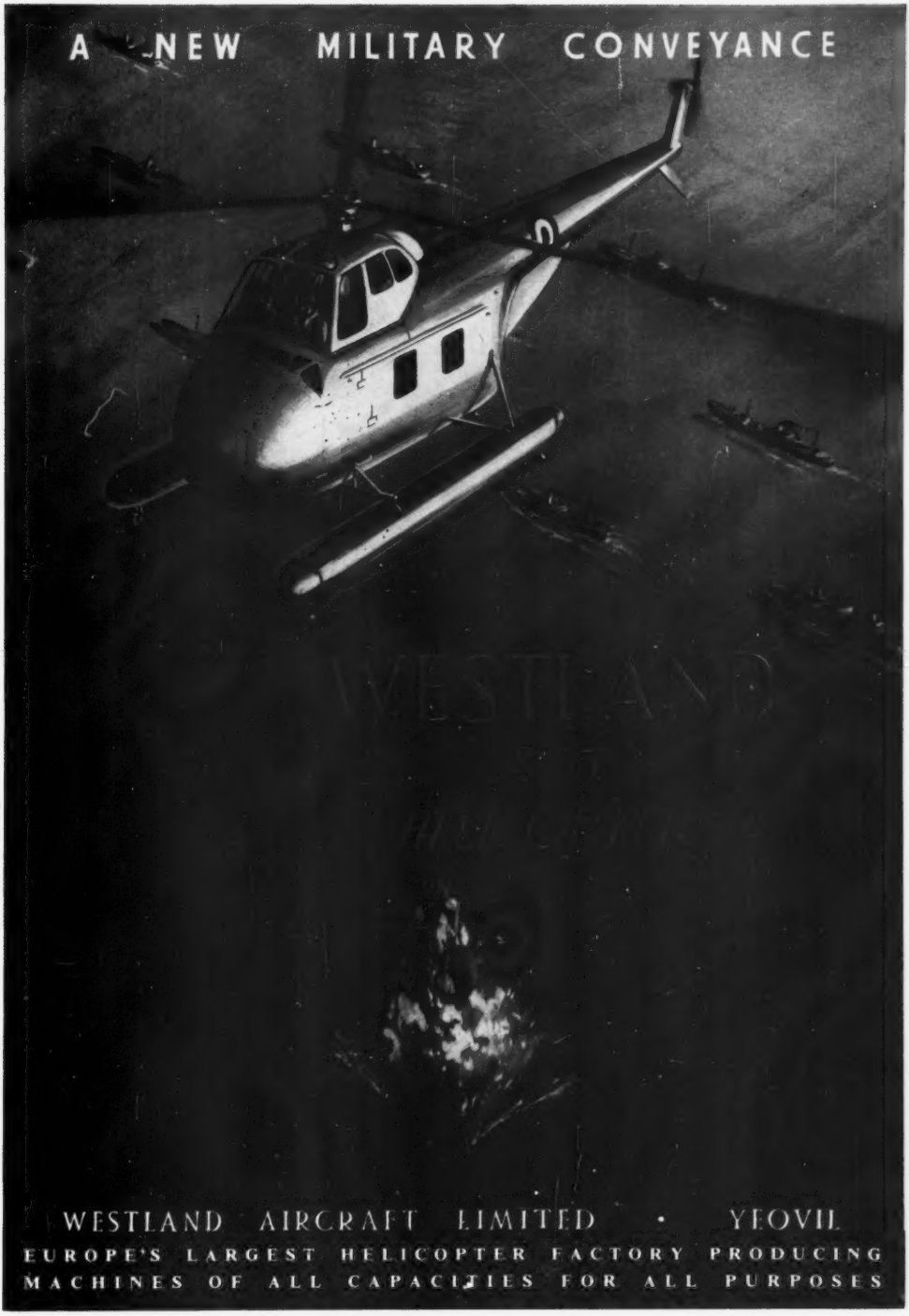
AN R.C.A.F. crew will fly the Avro Canada Canuck on its forthcoming non-stop flight from Gander to Aldergrove; the pilot will be S/L. E. L. Baudoux, D.S.O., D.F.C., and F/O. J. W. Whelan will be navigator/radio-operator. The flight will be made next month and the exact date will be determined by weather prospects. In preparation, the Canuck has recently been engaged in a series of long-range fuel-consumption tests over Canada.

Although the time for the Canuck's crossing (with tail-wind assistance, probably less than four hours) will create a new transatlantic record, the flight is to be primarily a ferry operation. At the request of the C.A.S., Marshal of the R.A.F. Sir John Slessor, the Canuck will visit Boscombe Down for tests. A European demonstration-tour may ensue.

Gentle Giants

THE manager of Convair's flight-test section, B. A. Erikson, who has flown over 1,000 hours in B-36s, reveals in *Flying* that these bombers, by far the largest in the world, are as easy to handle as any bomber types of the last war. He remarks, however, that all B-36 test pilots are required to fly regularly in a Stinson Voyager light aircraft to maintain their "dimension-awareness."

The basic test crew for a B-36 is only six men: two pilots, two engineers, and two scanners aft of the wings to check the behaviour of engines, flaps and wheels. On the ground—except on the actual take-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EUROPE'S LARGEST HELICOPTER FACTORY PRODUCING
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AUSTRALIAN

BRAATHEN'S SOUTH AMERICAN

BRITISH WEST INDIAN AIRWAYS

CENTRAL AFRICAN AIRWAYS

DANISH AIR LINES

MALAYAN AIRWAYS

NEW ZEALAND NATIONAL AIRWAYS

NORWEGIAN AIR LINES

PAKISTAN AVIATION

SABENA

SOUTH AFRICAN AIRWAYS

SWEDISH AIR LINES

TASMAN EMPIRE AIRWAYS

TRANS AUSTRALIA AIRLINES

TRANS-CANADA AIR LINES

. . . and the world's largest civil Airliner the BRISTOL BRABAZON is fitted with **288** LODGE PLUGS

British-made throughout by Lodge Plugs Ltd. Rugby, England

HERE AND THERE . . .

off—the manually operated controls are locked to prevent damage by gusts. During taxying, the thrust of six Wasp Majors and the four J-47 jets is so great that the inboard and centre propellers are held in reverse pitch. For landing, the turbojets and outboard Wasp Majors are shut off at altitude; the B-36 normally lets down rapidly—at maximum diving speed. Four piston engines provide enough power for approach or overshoot.

By Any Other Name . . .

THE American designation B-57A has been given to the English Electric Canberra. The U.S.A.F. version, built by Glenn L. Martin, will be a night intruder.

Subconscious Subsonics

FLYING a Thunderjet at 30,000ft, Lt. Charles Hearn of the U.S.A.F. lost consciousness when the canopy burst. He came-to 12 minutes later 7,000ft over New York City and landed at Idlewild with only three minutes' fuel left.

North Korean Air Strength

DESPITE the fact that the North Korean Communists have lost 254 aircraft, including 24 Mig-15s, they still have a large air potential, according to a recent statement by Lt.-Gen. Stratemeyer, commander of the U.S. Far East Air Force. At one Manchurian airfield, he said, 50 aircraft, mostly Migs, were recently spotted from the air.

Shot to Safety

ALTHOUGH the success of the Martin-Baker ejection seat has been amply proved under experimental conditions, emergency use of the device has, fortunately, been rare. The first British Service pilot to save his life by this method is believed to be Lt. P. L. McDermott, R.N., who escaped from an Attacker Naval jet fighter on March 20th near West Raynham. There is only one other recorded occasion when the Martin-Baker seat was used in an emergency in Britain—in 1949, when Armstrong-Whitworth test pilot J. O. Lancaster baled out of an A.W.52.

MANY METEORS—fresh from the Gloster production lines—were inspected by the Minister of Supply when he visited Moreton Valence last week. Meteors Mk 7, 8, 9 and 10 are shown.

IN BRIEF

A REVISED standard for B.S. 1161, *Aluminium and Aluminium-alloy Sections*, has been issued (price 5s post free) by the British Standards Institution, 24 Victoria Street, London, S.W.1.

* * *

E. D. Wynn and Co., A.I.D.- and A.R.B.-approved stockists, have moved into new premises—which include an aircraft-instrument laboratory and a bonded store—at Staverton Airfield, Gloucester (Churchdown 3264).

* * *

An addition to the list of firms who contributed to the Canberra's Atlantic-flight success is King Aircraft Corporation, Glasgow, S.W.2, who supplied all-metal, flexible, fireproof pipe couplings for the cockpit-heating system.

Intricate plastic mouldings and resin-impregnated fabric tubing sections are illustrated in a leaflet from Elco Plastics, Ltd., and Tube Lamination, Ltd., Desborough Park Road, High Wycombe.

* * *

Referring to a recent note on the *Flexelite Flexible-tank Manual*, Marston Excelsior, Ltd., wish to emphasize that its circulation is restricted to users.

* * *

S/L. A. R. Moore, technical adviser to the Royal Swedish Air Board and technical representative of the SAAB company of Linköping and the STAL gas turbine company of Finspong, now has offices at Princes House, 39 Jermyn Street, London, W.1. (Grosvenor 7581).

SEARCHERS: Two of the U.S.A.F. aircraft, pictured at Shannon Airport, which took part in the air-sea search for survivors of the C-124 Globemaster lost over the Atlantic on Good Friday with 53 aboard. The Grumman SA-16A Albatross amphibian (right) has external tanks for extended range; the Boeing SB-17 Fortress below carries an airborne lifeboat.

THE R.Ae.C. IN 1950

Lord Brabazon, at A.G.M., Reviews a Year's Work and Presents Medals

AT THE MEETING: (left to right), Mr. Fred Dunkerley, Sir Geoffrey de Havilland, Mr. Philip Wills (with the Britannia Trophy before him), Lord Brabazon, Major H. A. Petre.

"Flight" photograph

SPEAKING at the annual general meeting of the Royal Aero Club on March 28th, the chairman, Lord Brabazon, revealed the name of the "airfield very near London" at which the Club's "Fifty Years of Aviation" exhibition and display will be held from July 19th-21st; the choice is Hendon—and this much-built-round airfield, with its pre-1914 associations, should be eminently suitable, since veteran aircraft can be flown within its boundaries.

The chairman, as is customary, was giving an all-round review of the year's work. As regards the Club itself, both the Londonderry House and 119 Piccadilly accounts showed, he said, a small surplus, for which thanks were due to the finance committee under the chairmanship of Col. Devereux. Lord Brabazon then went on to express appreciation of the work of the various other committees and those who served as trustees to the Kemsley Flying Trust, which had so greatly contributed to the success of the 1950 National Air Races; he also mentioned the other good work of the Trust, particularly in the gliding field. He next reviewed, briefly, the principal record and other achievements of the year in which the R.Ae.C. had played a vital part.

The number of aviators' certificates issued had showed a slight increase, though this was largely due to the number of Service-trained pilots now qualifying for civil licences and also, to some extent, to the A.T.C. scholarship scheme. R.Ae.C. official observers had been appointed to R.A.F. stations, and of the 668 certificates issued in 1950, 323 went to Service-trained pilots and 61 to A.T.C. cadets.

Lord Brabazon then gave a résumé of the Club's current services to British aviation; they included the provision of world air maps, and journey-briefing; route books; reduced-fee annual landing cards; the obtaining of an official concession whereby business-aircraft owners could use Service airfields normally open to charter aircraft; another concession, for the issue of pilots' R/T licences without medical or technical examination; the reduction of C. of A. renewal fees; preparation of an inexpensive log for private pilots; and the issue of renewal reminders for various documents. These services were all extra to the normal issue of Customs documents, organization of sporting events, timing of records and liaison with governing bodies abroad.

Reviewing forthcoming events, Lord Brabazon made the announcement of the "Fifty Years" display already mentioned, and also referred to the fact that Princess Elizabeth had consented to attend the Festival of Britain National Air Races at Hatfield on June 23rd.

At the end of the meeting Lord Brabazon presented the Britannia Challenge Trophy to Mr. Philip Wills, C.B.E., for his achievement in winning the British National Gliding Championships for the fourth time (this is only the second occasion on which the trophy has been won for a gliding achievement). He also presented R.Ae.C. Medals to three well-known pilots for distinguished achievements in sporting aviation. Capt. Sir Geoffrey de Havilland, K.T., C.B.E., received a Silver Medal in recognition of the fact that he has piloted aircraft for 40 years and still possesses a current pilot's licence. Accepting the medal, Sir Geoffrey said that of all the honours which had in the past been bestowed upon him, he regarded this one as being "the only one which he had actually deserved"—for, as he explained with characteristic modesty, in this instance it was not possible to employ anyone to hold a pilot's licence on his behalf!

Another recipient of a Silver Medal was Major H. A. Petre, D.S.O., M.C., who has flown, chiefly as a private pilot, since 1911. Major Petre is still flying light aircraft and gliders.

The Bronze Medal was presented to Mr. Fred Dunkerley for his outstanding performance in 1950 when, piloting his Cirrus-engined Gemini, he won the Kemsley Challenge Trophy and the Siddeley Challenge Trophy, was third in the Goodyear Trophy race and gained fifth place in the King's Cup Race.

A SAILPLANE'S "NATIONALITY"

IN the House of Commons on April 3rd Mr. Turton (Con., Thirsk and Malton) was to ask the Minister of Works why the Eon Olympia, "a sailplane of German design", is to be shown in the Festival Exhibition; and whether he would confine the Exhibition to "products of British design and manufacture."

To the many members of the aircraft industry who are conversant with the Eon Olympia and its background, and to all gliding enthusiasts, this question regarding the design, and particularly manufacture, will seem strange. The Eon Olympia is, of course, manufactured entirely in this country and its design has been altered to such an extent that it can no longer be regarded as bearing more than a distant relationship to the German Meise, which won the design competition for Olympic sailplanes. From the makers of the Olympia Eon, Elliotts of Newbury, Ltd., Berkshire, we have received a summary of its development which brings these facts out clearly.

The German Meise—upon which the design of the Olympia Eon, in common with certain French and Swedish sailplanes, is based—was designed shortly before the war by Hans Jacobs at D.F.S. Darmstadt to comply with the Olympic Games specification laid down by the International Commission for the Study of Motorless Flight. After flight tests in Rome had proved the Meise to be the best of the designs submitted it was decided by the Commission that this type only would be allowed to compete in future Olympic Games events. (See *Flight* for July 8th, 1948.)

For this reason, and because the specification was considered at the time to represent an ideal club sailplane for advanced soaring, it was decided to base the Olympia Eon on Jacobs's design, Certain improvements were, however, suggested and incorporated in the British design. They were as follows (the first two items were, in any case, rendered obligatory by circumstances) :—

(1) The main spar was entirely redesigned to comply with current British Civil Airworthiness requirements on strength of sailplanes designed to fly in clouds.

(2) The majority of the structure had to be redesigned to utilize available British materials (spruce, plywood, steel, and standard parts), which are not interchangeable with German materials as regards size or mechanical properties. The majority of the ribs and frames were at the same time changed from the German T-section boom to the more usual, and economical, British L-section.

(3) Introduction of a second towing position, to permit a much steeper climb on winch-launching.

(4) Substitution of central landing wheel, and nose skid, for the German long central skid.

(5) Substitution of a one-piece clear acetate "bubble" windscreen for the German structure of light-alloy tubes with its numerous very small panels.

(6) Redesign of rudder pedals and associated fuselage-nose structure, substituting hanging-bar-type pedals for the German "harmonium" pattern.

(7) Redesign of the air-brake control system in the fuselage,

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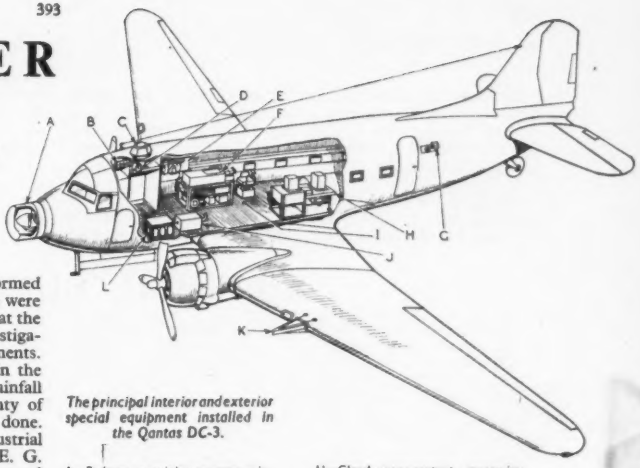
RAIN-TRAINER

Qantas DC-3 Equipped for Combined Rainfall-research and Crew-training



The principal interior and exterior special equipment installed in the Qantas DC-3.

A—Radome containing antenna unit.
B—Auxiliary instrument panel.
C—Astrodome.
D—Auxiliary BC-1153-A indicator.
E—Capillary-collector panel.
F—SCR.717B radar equipment.
G—Aerial psychrometer.
H—Cloud-water-content measuring instruments.
I—Position of "dry-ice" chute.
J—Inverter unit and soundproof box.
K—Cloud-water-content pick-up.
L—Oxygen bottles.

VAST tracts of land in Australia could be transformed from useless waste into productive areas if there were sufficient water. It is not surprising, therefore, that the Commonwealth has shown active interest in the investigation of cloud formations and in rain-making experiments. In many countries there are those who believe that in the not-too-distant future it will be possible to regulate rainfall to some extent; but before there can be any certainty of success an immense amount of research has still to be done.

In Australia, the Commonwealth Scientific and Industrial Research Organization, under the leadership of Dr. E. G. Brown, has a radiophysics division which has devoted a good deal of time to such work. Its present programme provides for extensive research into the physics of clouds and of natural rain formation. By making possible the measurement of the magnitude of rainstorms and the examination of the composition of a cloud, micro-wave radar, a war-time development, has provided the meteorologist with a most valuable new instrument.

Appropriate radar equipment carried in an aircraft—and this, of course, is where Qantas Empire Airways fit into the picture—makes it possible to seek out the rain-clouds and fly round, over and through them in order to measure and observe at first hand the type of precipitation, whether snow-flakes, ice crystals or water drops. Analysis of this information, supplemented by data on turbulence, is expected to explain the mechanisms involved in natural rainfall.

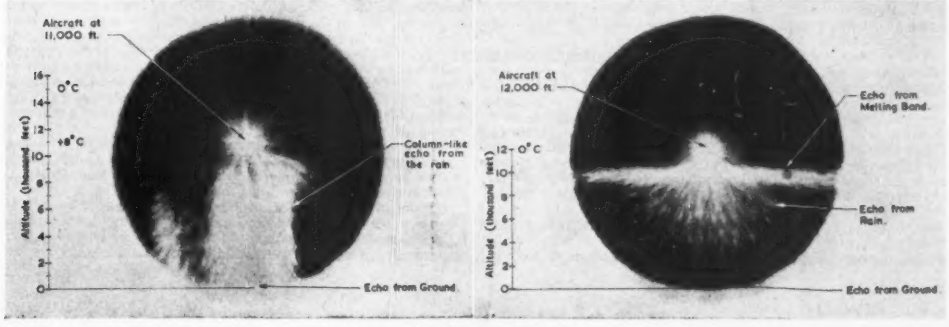
In August of last year, C.S.I.R.O. discussed with Qantas the possibility of chartering a DC-3 aircraft for airborne radiophysical investigations. (Previously the work had been carried out with the aid of the R.A.A.F.) Some ten to fifteen flying hours per week were foreseen, and a scheme was worked out whereby part-time crew-training could be worked in with the investigation flights. A standard passenger-type DC-3 was selected, and some 3,000 lb of equipment was installed (see illustration). The aircraft itself was modified by the installation of a large-capacity oxygen system for high-altitude work and—to provide additional electric power for the research equipment—200-amp generators in place of the normal 50-amp type of the DC-3.

Research equipment includes SCR.717B 10cm-wavelength radar, the antenna for which is mounted in a radome on the nose of the aircraft. As the antenna revolves in a plane at right-angles to the line of flight the position and magnitude of echoes reflected from objects such as the ground or a rainstorm are presented to the observer in the usual manner on the cathode-ray tube. The aircraft itself appears as a spot on the centre of the screen, the ground-echo is visible at the bottom, and any echo from a rainstorm appears between the two. A second cathode-ray tube in the recorder permits accurate measurement of the intensity of the echo received from the storm. A camera and timing equipment secure a continuous record for subsequent analysis.

The various well-defined types of rainstorms produce characteristic echoes. For instance, heavy rain observed to fall from cumuliform clouds lying wholly below freezing level have a column-like shape and an intensity which is relatively uniform from the top right down to the ground (see illustration). The mechanism of natural rain formation thought to be involved in such a case is that some of the cloud droplets grow first by condensation then more rapidly by coalescence with other water drops. There is reason to believe that this process also takes place in some of the larger clouds which extend above freezing level. Another characteristic type of echo (also illustrated here) is that produced by stratiform cloud in which, according to theory, ice crystals form in the sub-freezing region, fall down through the cloud, growing in the process, and melting at a point just below freezing level to emerge finally as rain. An intensified echo is received from the layer—known as the melting point—just below the freezing level (this phenomenon is sometimes referred to as "Bergeron rain," after the scientist who propounded the theory).

A sideline to these investigations is the information provided on aircraft icing. When an aircraft is flying above

(Left) Radar echo from heavy rain from clouds below freezing-level. (Right) Echo from ice-crystals falling through cloud, melting, and forming rain.



RAIN - TRAINER . . .

freezing level in the presence of snowflakes or ice crystals rime ice may be expected to build up on it. During flight above freezing level through rain of the non-freezing type, in which no ice is present, an accumulation of clear ice may be expected on the aircraft. From this basic knowledge, applied practically to aircraft operation, it may be possible to forecast the probability of icing, and the type of ice to be expected, by means of the characteristic radar echo.

Because information is required on the conditions existing in a cloud before it starts raining, additional equipment is carried on the DC-3 used in the investigations. For example, the liquid content of the cloud may be measured, and two methods are employed for this purpose. In one, a strip of absorbent paper moves across a slot in an instrument mounted on the port wing. The electrical resistance across the paper varies according to the amount of water absorbed and is continuously measured and recorded by instruments in the main cabin. The second method involves the use of a porous plug consisting of a number of capillary tubes which collect the water and pass it *via* rubber tubing to suitable volume-measuring apparatus.

AIRFIELD SUPER-VISION

THE radio and radar aids at present available to aircraft are all concerned with airborne movement, but a new radar aid known as A.S.M.I. (Airfield Surface Movement Indicator) is designed to monitor movement on the airfield surface. As such, its principal function is to aid the control of all aircraft and vehicular movement on the runways and perimeter tracks during fog or poor visibility.

The A.S.M.I. equipment is the logical outcome of development work carried out by its manufacturers—A. C. Cossor, Ltd., London, N.5—in harbour-supervision radar, in that the technical requirements are essentially similar, viz., high resolution (narrow beam-width, short pulse-length), low minimum range, simplicity of display and ease of operation for non-technical personnel. The equipment operates on a wavelength of 3 cm, and with a 12-ft wide scanner this gives a beam of but half a degree width. A pulse-width of less than 0.1 microsecond, and a special wide-band receiver, thus give the necessary high degree of discrimination.

The P.P.I. display is given on a 15-in oscilloscope and, by means of a special facility, the centre of rotation of the P.P.I. trace can be moved anywhere over the face of the tube, so permitting the entire screen to be used for the radar map of the airfield. The scale of the picture presented is also adjustable and can, in fact, be as large as 15in to a mile.

We were able to see the performance of this new equipment during a recent demonstration at London Airport. For this purpose, the A.S.M.I. equipment had been installed in a coach with the scanner on the roof, and was positioned adjacent to the London Radar site. Even to unpractised eyes the efficacy of A.S.M.I. was impressive. Certainly, the "returns" from a large number of temporary buildings and the extensive constructional works and equipment at the airport were an unwanted feature but, we were assured, all such detractions could be (and no doubt will be) "painted-out" of the final installation. But that movement along the runways and taxi-tracks—and along the Bath Road for that matter—could clearly be seen was incontrovertible, and there can be little doubt that, by the combination of A.S.M.I. with V.H.F. communication, the whole problem of surface-movement control at airports large and small, particularly in conditions of poor visibility, will be well on the way to practical solution.

A = parked aircraft. B = control tower. C = aircraft landing. D = radar site.
Radar P.P.I. map of London Airport given by the A.S.M.I. equipment

A SAILPLANE'S "NATIONALITY"

(*concluded from page 392*)

substituting a British style of lever, with cables and pulleys, for the German sliding bar.

(8) Complete revision of the design of the main wing and fuselage joints to ensure interchangeability of components, and to permit easier rigging by a smaller ground crew.

(9) Introduction of a British patent quick-release pin at all the control de-rigging points.

(10) Installation of oxygen equipment.

This redesigning involved the preparation, checking, stressing investigation and submission for A.R.B. approval of over 600 drawings, as well as the complete full-size "lofting" of all the contour lines of the aircraft. Performed by nine designers, draughtsmen and stressmen at various times over a period of about eighteen months, this work took about 5,000 man-hours to complete. Flight testing for British Civil Airworthiness Requirements was carried out by an independent body, B.G.A. Test Group No. 1, at Redhill, and occupied about four months. Shortly after this, an Olympia Eon was flown by Mr. Charles Wingfield in the American National Gliding Contests (at the expense of Elliotts) in order to try it against the best the U.S.A. had to offer at that time. The aircraft set up a new out-and-return distance record.

The type was received with enthusiasm by the majority of soaring enthusiasts in this country; as proof, the makers give this analysis of entries in recent British national Contests :—

	1947 per cent.	1949 per cent.	1950 per cent.
Olympia Eon entries	50	52	48
All other British-design entries ...	14	20	26
Foreign-design entries	36	28	26

(There were no official contests in this country in 1948.)

Elliotts of Newbury state that the Olympia Eon's design has been kept under constant review in consultation with official bodies and clubs, and in the past four years this has resulted in over twenty modifications, all aimed at "improving the breed." Comparison of the operating limitations of the German Meise with the 1951 version of the Olympia Eon give a measure of this improvement. For example, the British type is authorized for an all-up weight of 670 lb and is permitted to enter cloud, whereas the all-up weight of the Meise is 550 lb and by British standards of airworthiness is not permitted to enter cloud.

In the past three years, incidentally, the Olympia Eon has secured export orders to U.S.A., Iceland, Portugal, Pakistan, Australia, Canada, Denmark, Palestine, India, New Zealand, South America, Belgium, South Africa, and Malaya.

Elliotts of Newbury also produce two other glider types, the Baby Eon and the Primary Eon, and this work, and developments in connection with amendments for Service use, have occupied the majority of this firm's attention for the past five years.

Meteorific performance Plus

In addition to a maximum external load of twenty-four R.P's, an alternative of either four 1,000 lb. bombs or extra fuel in ventral and underwing drop tanks may be carried on this, the new tactical ground attack version of the Meteor.

A further alternative armament load can be effected by the attachment of a streamline blister pack beneath the centre section, containing two additional cannons.

Wing tip tanks are a standard fitting and provision for R.A.T.O.G. ensures that the full potentialities of this essential and very formidable aircraft can be employed under the most adverse of take-off conditions.

GLOSTER METEOR

Tactical ground attack Fighter

GLOSTER AIRCRAFT CO. LTD. (Member of the Hawker Siddeley Group)

P.V.

COMET

four de Havilland Ghost turbines

The most up-to-date airliner in the world

DE HAVILLAND

DH AIRCRAFT

DH ENGINES

ON FLYING-BOATS

A Short Hythe (four Bristol Pegasus engines) of Aquila Airways, Ltd., now the sole British operators of large commercial flying-boats.

REFLECTIONS OF AN OLD HAND . . . By J. LANKESTER PARKER, O.B.E., F.R.Ae.S.

A VALUABLE contribution to the literature of marine flying is an informal dissertation by Mr. J. Lankester Parker, O.B.E., F.R.Ae.S., who will always be remembered as chief test pilot and (now) as a director of Short Brothers. Though quite unpretentious, the article presents some major issues with exceptional clarity. It appears in the *Journal* of the Guild of Air Pilots and Air Navigators, to the editor of which we are indebted for permission to reproduce it here. In the original article Mr. Lankester Parker begins by saying that his first reaction on being asked to write it was to refuse on the ground that flying-boats were now, perhaps, to be classified with dirigible airships—as old-fashioned devices that elderly gentlemen loved to talk about in the comfort of the club lounge. But, as will be seen below, he soon warms up to his subject.

IT is, I am told, a sign of old age when one's main concern and interest is centred around things and events of the past. But it would seem that, despite my years, I am not yet fully qualified in this sphere, for it was only after I had made up my mind that flying-boats have a future, perhaps a very important one, and that there are lessons to be learned from those already in being—useful both to flying-boat and runway-using aircraft designers—that I agreed to write this article.

In the beginning there were special difficulties facing the would-be seaplane flyer, and it was not for some years after aircraft flew successfully that anyone managed to take off from water. The great resistance of water to high-speed motion seemed to be a problem impossible of solution. But man is a stubborn animal and does not readily give up, particularly, I think, if he does not suffer from a pseudo-education which has taught him to think he knows what is and what is not possible—and so he continued to experiment. These researches led to the development of the planing bottom. Which means that, by suitably shaping its under part, a hull which is entirely supported by its water displacement (or buoyancy) when at rest becomes subject to dynamic forces when moved. These forces get larger and larger as speed increases until finally the hull can be said to be entirely so supported. It is as though an airship, which can remain airborne at no air speed, could entirely dispense with its gas as it got under way. Both submarines and airships are, of course, subject to substantial dynamic forces or they would not be fitted with elevators. But not to the same degree as flying-boat hulls.

I claim indulgence for the length of the above explanation, for there is some misconception in the matter. The idea that the hydroplane runs along the surface at speed is not really sound. In truth, the existence of the surface is a complication rendering it more difficult to achieve as high an efficiency as when the wing (aerofoil or hydrofoil, if your prefer) is entirely surrounded by the fluid, as with an aircraft in flight.

During the course of these early experiments I well remember one, which was, to the few of us privileged to watch, a very amusing episode. A rather eccentric gentleman, an inventor of some note in other spheres, thought the planing-bottom idea unsound and so fitted a craft with two large hollow wheels of suitable buoyancy. The underlying principle, it seemed, was that, as speed increased, the wheels would rotate until they would be running over the surface of the water on the same principle that a car can travel at high speed over sand so loose that it would become bogged in it if speed were reduced.

It turned out that this ingenious water-craft had a maximum speed of not more than walking pace, for the drag must have been terrific, and the wheels turned slowly and sedately in the wrong direction! A huge bow-wave built up in the front of each wheel as though the devil in the water had formed himself into a chock to prevent forward progression and mock at man, the fool. It was cruel of us to laugh, for there was much to be learnt from that experiment.

History alone can tell whether flying-boats will ever again be used—except, of course, in a small way for special and unusual duties—but it is fitting, I think, at this stage to pause awhile to look back at the past and ponder the way development might have taken place had it been a straight battle of man *versus* Nature and not one complicated with international tension and war.

When the Short "C" class flying-boats first went into service with Imperial Airways in 1936, and did a magnificent job of work on both the Australian and South African routes, there were few, if any, aerodromes in the world from which a landplane of this size and performance could be operated. Even if there had been, the point of my argument remains, for the "C" class could have been used if, by some stroke of genius, they had been produced ten years earlier. Of what use would, say, a Constellation, magnificent aircraft that it certainly is, have been in those days? Indeed, of what use would it be to-day except for the aerodromes created to satisfy the needs of war and to serve national prestige? I very much doubt if economically the aeroplane would be in the running against the contemporary flying-boat for civil use if both had to bear their full operating costs reflected in the fares. Whilst it is true that one has to deal with a world as it is, and not much is normally to be gained by spending time in reflecting how it might have been and in what way other conditions might have affected the development of aircraft, such reflections are worth while from the point of view of how the immediate future may be concerned. It is not necessarily correct to assume that the impact of military requirements will play so important a part in the future as they have done in the first half-century of aeronautical progress.

There is much difference of opinion as to what constitutes the ideal size for the long-range civil aircraft. Much weight attaches to the view that frequency of service and cruising speed are the goals at which to aim, and that we have already reached, some think exceeded, the ideal size. I remember very well the same arguments being put up, largely by the operators, about the good old Dakota, at the time it was in its prime. Personally, I have not the slightest doubt that aircraft larger than any at present in service will be in regular use by the airlines of the world in the not-far-distant future. The stressing problems inherent in the large spans in disturbed air will be taken in their stride. After all, the Tiger Moth is of almost infinite size to a household fly, and the fly stressman must wonder indeed how the clever human copes with the hundred-and-one up currents and down currents that so great a structure must be subject to at one and the same time!

In the event of my forecast on size proving right the important question will arise: will the military requirements of the world provide large enough aerodromes, suitably sited and in sufficient numbers really to satisfy civil needs and standards of safety? The answer to this question is anybody's guess. My own is that crew-carrying military aeroplanes, other than as a sort of glorified army service corps, may well be non-existent.

To get back to my seaplane story. I said earlier that the problem of overcoming the resistance to high-speed motion through water had to be solved before seaplanes could fly at all. Even then they

Models of (above) the Saunders-Roe Princess, with four Coupled Bristol Proteus and two single Proteus, and the Duchess (four de Havilland Ghosts). The Duchess is designed for a gross weight of 130,000 lb and should cruise economically at about 470 m.p.h.

ON FLYING-BOATS . . .

flew much less surely than did the contemporary aircraft because of the increased air resistance and weight of the floats as compared with the skids or wheels they replaced. This defect showed up either as a reduction in carrying power or in performance. Despite this it was not very many years before the world's speed record was captured by a seaplane. It will be suggested that this was because of the money, and therefore the research, put into the winning of the international Schneider Trophy Race and that, had a similar prize been offered for the fastest landplane*, the landplane would have held pride of place. I think this is unsound logic unless the prize had been enormous for, in addition to the cost of producing the landplane and engine and all the other bits, it would have been necessary to provide the aerodrome from which it could operate. It would have been essential to make the landing chassis retractable; not a very easy problem with a thin-wing biplane, which for a long time held supremacy over the monoplane. Fuselage space, into which the wheels conceivably might have been retracted, was limited. Indeed, the floats of the seaplane were found to be most useful for the storage of fuel and as cooling surfaces. We were not dealing with self-cooling jets then, and disposing of the heat generated by those powerful racing engines was one of the bigger problems.

The flying-boat, despite the handicap of facing less competition than its landplane rival, because it was produced by fewer firms and in smaller numbers, held its performance superiority until the coming of the cantilever monoplane with variable-pitch airscrews and retractable chassis and—perhaps the most important aid of all—the provision of hard runways of sufficient length to enable advantage to be taken of higher landing and take-off speeds. So flying-boats have been slower, then faster, and now not so fast as their rivals. Who is to say that history will not repeat itself?

Finer Points

Without regard to the question concluding the last paragraph, the flying-boat can be a thing of beauty and a useful piece of apparatus, and I would like to say something about its finer and lesser-known points. The reader may have gathered already that it is my contention that the flying-boat of 15 or 20 years ago was more advanced than the landplane. It was much more nearly analagous to the modern aircraft with retracting tricycle undercarriage. The air resistance of the hull with faired steps was considerably less than a fuselage-cum-fixed-landing-chassis. It floated at rest with the hull roughly level, a feature not perhaps fully appreciated at the time, but it was a great asset to the maintenance engineer and a great comfort to the crew and passengers. The risk of blowing over at moorings was almost entirely eliminated. It had stable directional qualities, of which more anon.

For the benefit of those who have not had boat experience I will describe, very briefly, a typical take-off.

As speed is gained on the take-off run, the hull attitude, and, of course, wing incidence, becomes increasingly greater, and therefore much of the load is, early in the run, transferred to the wings. In this way a quicker take-off is achieved, for no hull within my experience has a better lift/drag ratio than about 5:1, whereas wings may realize easily a figure of more than double this. By the term, "hull lift/drag ratio", I mean the weight supported by the hull bottom (or, if you prefer, gross weight less wing lift) against water resistance. As speed (we are still on the take-off run) further increases, the hull attitude tends to get rather less, again so that the final "unstick" is made not at the stall, but at a speed about 1.2 times greater. The foregoing is a description of what might be expected to take place as the result of natural running, though, in fact, the pilot has a considerable degree of control over attitude at all times. He would, of course, also have to maintain course and possibly keep laterally level as well.

The good boat of the period I have in mind was directionally stable on the water, a quality surely not possessed by any non-tricycle aircraft chassis. Perhaps I make too big a point of this, and I do agree that a directionally unstable hull or chassis does not necessarily make the aircraft, or flying-boat, unacceptable. Such a chassis or hull fitted to an otherwise good aircraft, suitably finned and ruddered, braked and throttled, and so on, can be made to do most anything, including take-offs and landings out of wind; but that does not imply that the hull or chassis is itself stable or, may I say, a good one. To avoid any misconception I define directional stability, whether in a hull or a chassis, as that quality which causes the said hull or chassis to tend to turn down-wind when proceeding across-wind—in opposition to the weathercock tendency of the aircraft as a whole. For the same geometrical reasons it tends to oppose any swing or change of direction forced on it.

There is still one other great difference between a normal flying-boat and an aircraft on which I have not yet touched. As I have tried to show, the flying-boat has many qualities in common with the tricycle-chassis landplane but, I want to carry the analogy to its limit, to a one-wheel "tricycle," if I may be forgiven the term. This arrangement has some virtues as well as disadvantages. The virtues are mostly from a structural point of view; surely it is better fundamentally to have only one point of major force application, as when supporting the weight of a necessarily ungainly device such as a large aeroplane out of its natural element, on the ground. One has only to look at a swan or a sea lion on dry land to see what I mean. Especially is this so if, as with a flying-boat, the forces are distributed evenly and gently over a large area rather than concentrated at certain fixed points. Large racking strains, inherent in twin hulls or two wheels, are avoided. There are, of course, snags. One of the greatest difficulties confronting the flying-boat designer is to achieve lateral stability on the water, both when at rest and when taxying. The nature of the beast renders it impossible to get shiplike stability; the metacentric height is much too high.

There have been three major lines of research into lateral stability: (1) the double-hull or twin-float seaplane; (2) the single hull with sponsons or water-wings; and (3) auxiliary floats along the wing, usually called wing floats.

With the twin-hull arrangement most of the structural advantages inherent in the flying-boat disappear. Seaworthiness is, in my own experience, very greatly lessened. I suspect air drag may be high.

Sponsons have undoubtedly some great advantages over either of the other methods and were much favoured in Germany, but they also have some very serious disadvantages, of which I will list a few (not in order of importance), namely, greater air resistance, greater weight, and being more prone to damage by rough seas when taking-off or alighting. I believe they are good on rough seas once the boat has come to rest. But the major defect of the sponson method is that it fails to provide lateral stability under certain conditions, such as when taxying at that particular speed when the sponson itself is neither planing properly nor is an effective buoyancy float. So far as I know, no design of sponson yet produced provides the lateral stability at all speeds, thought

* *In the original article the term "land aeroplane" is used here, and, subsequently, "aeroplane". We have taken the liberty of changing this to "landplane" when it appears that the author is using it in contradistinction to "seaplane" or "flying-boat", otherwise misunderstanding might be caused. Possibly Mr. Lankester Parker dislikes the word "landplane"; so do we—but nobody has offered an acceptable alternative in 40-odd years.*—ED.

desirable in this country. Rightly, in my view, the British have in general adopted some form of the wing-float arrangement. The critics of this method contend that wing floats are necessarily somewhat fragile and very liable to damage; and they are the weak link in the flying-boat chain, invariably getting knocked off in the event of a forced landing in a rough sea, thus greatly increasing the risk of a total loss. That, because of their size and situation, they cannot reasonably be retracted and so cause a loss of performance under all conditions.

I suppose there is some measure of sense in all these arguments but they are all, I think, grossly exaggerated. Stabilizing wing floats can be positioned almost anywhere along the wing span. I personally favour the extreme wing-tip float because in this position, to satisfy any given stability requirement, it can be of the smallest dimensions. This is all in the interest of weight, air resistance and structural strength. In this position it can be not retracted inboard but raised to the wing tip, where it may well be that its drag is more than compensated by a reduction in induced drag of the wing itself, a phenomenon found in fighter aircraft to which long-range jettisonable wing-tip tanks have been fitted.

After a considerable study of the subject, I have come to the conclusion that wing floats are seldom lost or damaged as a direct result of rough seas. Indirectly sometimes, yes. For instance, when a boat has been badly landed or has been bounced off again at a stalled speed, and falls back again wing-tip first. More often the loss of a wing float has followed an alleged good landing on a smooth sea, a glassy smooth sea, and probably in poor visibility. I cannot conclude on such a disturbing note and so claim indulgence once more to digress awhile.

No, I do not believe that waves knock floats off, as is generally supposed, either at moorings, adrift, or when taxying fast. Waves are not what they seem; except when breaking on a shore, the water composing them has no velocity. Though waves can vary much in shape, they are usually much flatter than they look and they do not contain much energy. How could a small ship create such big ones if there were? The mass is great but it moves slowly. If enough water gets on a ship's deck the deck will collapse, but it is not, I contend, wave energy but just plain weight of water that does the damage.

A properly shaped wing-float at the proper incidence will stand an amazing amount of collision with waves. Its very shape is its own shock absorber, but no float can stand being propelled at high speed through the water submarine fashion. Try to imagine the resistance of such a body at a mere 80 knots. It is quite impossible to stress for. Here, I think, lies the answer to the mysterious loss of wing floats in the past. Too high a landing speed and/or too fine an incidence, an improperly shaped float, and it is under and off. I hope I have not implied inadvertently that I consider there is a limit to the practical landing speed of a flying-boat, for I do not. Provided the hull contacts the water at the correct attitude, I see no practical limit to speed such as, in the case of a landplane, might well be wheel r.p.m.

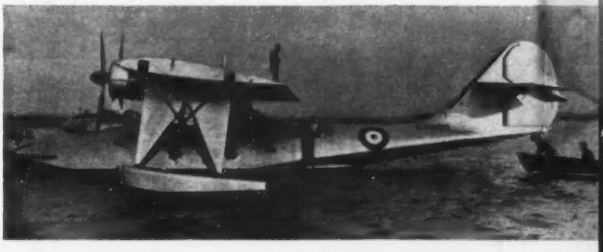
There were innumerable cases on record in the last war where Sunderlands survived rough seas, sometimes without suffering any damage at all. There was the famous occasion where a Sunderland, its petrol tank holed by enemy action, alighted in a big sea and was towed by a corvette for 74 hours to base. Despite storms and a big swell, it suffered no damage. Perhaps the epic was when a Sunderland, patrolling some 400 miles south-west of Iceland, was forced down in a full gale as a result of a defect in the fuel system. The seas were terrific, and the captain, fearing the boat would founder before they could be rescued, invited the rest of the crew—the defect having been rectified—to take the risk with him of attempting a take-off. They all agreed, for, although they knew the odds against them were great, they felt it was their only chance. After one false attempt, out of wind but along the waves, they had another go and this time, aiming straight at the seas, they succeeded. It was a terrifying experience; they hit the waves a number of resounding cracks before finally getting clear. The hull was severely damaged, the airscrews bent to an incredible shape, the whole ship was almost a "write-off", but they flew home with the wing floats still in position and doing their job. That sort of story helps to confirm my faith in the type and in the future of the flying-boat.

In conclusion, I am going to have the audacity to offer a word of advice to the flying-boat designers of the future. Do not risk the many brilliant qualities inherent in the type too much in an effort to surpass landplane performance, and avoid at all costs the trend to develop on lines being pursued by some foreign countries particularly America, at least until their boats are as good as our own. Let us continue to have courage to carry on in our own way.

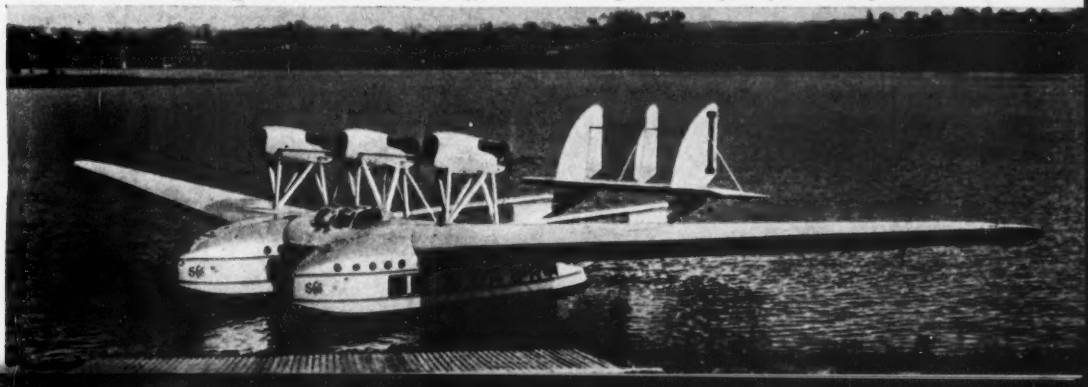
Short Sunderland (Great Britain) with lateral stabilizing floats.

Dornier Do 24 (Germany) with "sea wings," or sponsons.

Consolidated Catalina (U.S.A.) with floats retracting at the wing-tips.

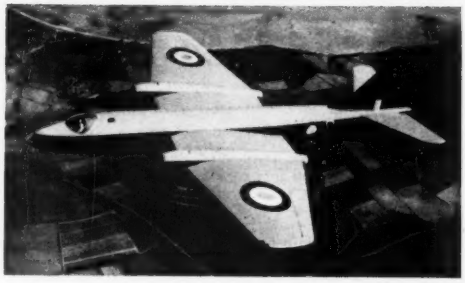


Savoia-Marchetti S.66 twin-hull flying-boat. Machines of this same general type, with two or three engines, were widely used by the Italians before the war.



COUNTERPART

DEPICTED in the *Flight* copyright drawing above, by Barry Jones, is a new Russian twin-jet tactical bomber, the probable designation of which is Tu-10, signifying that it was designed by Andrei Tupolev. A counterpart of the English Electric Canberra, a *Flight* photograph of which is reproduced for comparison, the Russian machine is probably of greater span. The thin wing is unswept, but the tail surfaces have sweepback. The main wheels of the nosewheel undercarriage retract into the massive underslung turbojet nacelles. Unlike the Canberra, the Russian bomber (an example of which appeared in the May Day fly-past over Moscow last year), appears to have tail armament. It succeeds an earlier Tupolev twin-jet light bomber, reported as the Tu-4.



AERONAUTICAL-ELECTRICAL INSTRUCTION

IN a recent review of a brochure published by the College of Aeronautics, Cranfield, Beds, we briefly mentioned the courses and facilities available for students. Now comes news of a new course of two years' duration, in which aeronautical and electrical engineering will be combined. It will begin in October next, with a yearly intake thereafter.

The aim is to give students a grounding in aeronautical engineering in general, together with a more specialist training in those branches of electrical engineering which find application in the aeronautical field.

In the first year the student will attend selected lectures and laboratories in all the main Departments of the College—aerodynamics, aircraft design, aircraft propulsion, and economics and production—to obtain the "background" essential for applying electrical knowledge in the service of aeronautics. The electrical training in the first year comes under five main headings:—

Applied Electronics.—This initially covers the fundamental principles of electricity (including thermionics), and goes on to deal with the increasingly important field of the application of electrical and electronic techniques in the measurement of physical and mechanical quantities.

Communication.—Here will be covered the general principles of the transmission of information to and from aircraft, with explanations of practical radio and radar equipment. It is not intended that this section should enable the student subsequently to design such apparatus, but rather that he should be able to assist the aircraft designer to make the best use of them, and should be enabled to give the equipment-designer advice on the aeronautical problems involved.

Aircraft Electrical Systems.—The general problem of the supply, storage and utilization of electric power in aircraft is dealt with. This part of the course also analyses the installation problems concerned with all classes of electrical equipment.

Servo-mechanisms.—Under this heading come all forms of automatic control systems. Fundamental theory is treated in some detail, and is followed by examples of current practice.

Aerials.—In view of the increasing use of "suppressed" aerials in high-speed aircraft, the fundamental theory of aerials is treated in detail. This is followed by an introduction to the problems involved in suppressing all forms of aircraft aerial.

In the second year the foregoing subjects are continued, but the student is allowed a greater latitude in selecting for deeper study those which particularly interest him. In addition, each student undertakes work on some research or development problem to form the subject of a thesis.

The course leads to the Diploma of the College, which is awarded on the student's progress throughout the two years, and on the quality of the thesis submitted.

The College is, of course, already well equipped for teaching in aeronautical engineering, and the present electrical section is being expanded to provide the facilities necessary for the new course. In addition to lecture rooms and an efficient workshop, there are five laboratories, and good drawing-office facilities. Some of the laboratories border on the airfield, which provides an excellent open site for work on aerials and radiation. One of the College aircraft is specially equipped with radio and radar devices for demonstrations in the air; in addition there is a ground demonstration room containing up-to-date radar and other navigation aids.

Students on entry should have a Degree or Higher National Certificate in Mechanical or Electrical Engineering or a degree in physics; in addition, the College may admit after interview applicants without these qualifications who are judged of equivalent educational standard.

It is hoped that trained students leaving the College will be of great value in the increasingly important guided-missile field; will serve the industry as a valuable link between the designers and manufacturers of aircraft and those responsible for the instruments and devices that are fitted in them; and be able to give help in air-traffic control problems.

A Fairey 17 (Armstrong Siddeley Double Mamba) during recent deck-landing trials. The double-folding mainplanes keep down folded height and give stability when stowed.

NAVAL-AIRCRAFT DESIGN

General Principles: Double Power Units; Background of the Fairey 17 and Double Mamba . . . By D. L. HOLLIS WILLIAMS, B.Sc., F.R.Ae.S.

INTRODUCING his paper *Some Aspects of Modern Naval Aircraft Design* to the Royal Aeronautical Society on March 29th, Mr. D. L. Hollis Williams, B.Sc., F.R.Ae.S., chief engineer of the Fairey Aviation Co., Ltd., divided naval operational aircraft into three classes: (1) the fighter group; (2) the strike group; (3) the general-reconnaissance group, which has anti-submarine work as its primary role. Since a large part of the author's time for the past few years had been devoted to the study of the anti-submarine problem, his principal references were to the third category.

Carrier-borne aircraft differed from their shore-based equivalents, he said, mainly because they were called upon to operate from the limited space in a carrier. The deck, he reminded his audience, was divided into front and rear portions by a retractable crash-barrier. Arrester wires were disposed athwart the after end of the deck, and the catapults were forward. Under the flight deck was the hangar—a long interrupted corridor, slightly narrower than the full beam of the ship, with a fair roof height. Ashore it would be regarded as a large, lofty, hall. At each end of the hangar were lifts. The length of the aircraft must not exceed the lift length, and the folded width was dictated either by the width of the lift or by the need to stow a number of rows abreast. Folded height was dictated by the height of the hangar roof, which was becoming fairly constant between the various classes of carrier. The closer the designer worked to the limiting dimensions, the more time was taken up in handling aircraft. The carrier pitched and rolled, and there had to be enough clearance on limiting dimensions for an aircraft to rock on its shock-absorber suspension without damaging itself on roof or walls.

Describing the take-off sequence, the lecturer told how the aircraft were brought up from the hangar, ranged at the after end of the deck in a tight park, with wings folded, and engines were then started-up. Meanwhile, the carrier was turning into wind and working up speed to give the appropriate air speed over the deck. The leader moved out from the park and manoeuvred to the starting point. He rolled a few feet forward to straighten all wheels and held the aircraft on the brakes; then he selected "wings spread", checked that the operation was complete, selected take-off flap and opened up to full power, or as much power as the brakes would hold. On the signal "go" he released brakes and took off along a white line, passing over the crash-barrier, which would be lying flat on the deck.

Normal practice at present was to accelerate fighter and strike aircraft off the deck. The accelerator was a long slot through which projected a forward-facing catapult hook. The aircraft was taxied into position at the end, and a cable connection was made between it and the hook, with a tie-back cable at the after end to keep the system taut. (The aircraft wings should have a positive angle of incidence, approaching the airborne incidence. They might have this built in, or it might have to be forced by ancillary means.) The pilot spread the wings, selected take-off flap, opened-up to full power and braced himself for the punch of the catapult. At firing, the hold-back cable broke, and at the end of the catapult stroke the pilot had a few feet of deck in which to rotate the aircraft to its full take-off incidence. Natural attitude on the catapult was extremely important and governed the speed at which the ship must be driven to get the necessary wind speed over the deck, and/or the accelerating force in the catapult. So that aircraft could be flown-off when conditions did not permit free take-off, and without using the accelerator, it was usual to equip them for rocket-assisted take-off.

The landing sequence, which appeared simple, could be perfected only by continuous practice. The aircraft, all set for landing, approached the carrier's stern from abeam to port. Within comfortable visual range the pilot placed himself under the signals of the deck-landing control officer. At constant height, just above deck level, he turned into the turbulent air stream aft of the deck; then, at a point in space judged by the batsman, the "cut" was given. The pilot shut off power, glided down to the deck, flared out just before contact, and the arrester hook grabbed a wire and decelerated the aircraft to rest. The final motion of the aircraft was a slight recoil from the elasticity of the arrester cable, which usually allowed the pilot to retract his hook and drop the wire. Failing this, the deck-crew rolled the aircraft back a few feet to release the wire. When the aircraft came to rest the crash-barrier was lowered, the pilot selected flaps up, folded the wings and taxied across the crash-barrier to the forward part. The barrier was raised immediately behind him and everything was set to receive the next aircraft, which was probably just turning "into the groove".

Should the batsman decide that the aircraft was not positioned to pull off a successful landing, he would give the "wave-off" and the aircraft then had to accelerate to a comfortable circuit speed. This involved plenty of reserve power to check the sink and produce acceleration; and, to avoid embarrassment to the pilot, the sudden increase of power must not be accompanied by violent trim-changes.

The first requirement in a naval aircraft was that the pilot should have adequate view. For years pilots had been deck-landing with no direct forward view and were able to keep the batsman in sight only by landing off a turn, looking to port. Later types had an unobstructed view, obtained in some cases by retracting the gun-sight or equipment. It seemed that if a pilot had some 8 or 9 deg downward visibility, measured from a datum parallel to the wing chord, he had all the view necessary for deck-landing, though other requirements, e.g., search and weapon-sighting, might demand greater angles.

It was important that the pilot should be able to concentrate his

The Fairey P.24 engine (below) comprised two 1,000 h.p. units. On the left, in the Fairey Battle, used as a flying-test bed, only one of the co-axial airscrews is rotating.

NAVAL-AIRCRAFT DESIGN . . .

attention on landing and not have to "jockey" his aircraft. In recent years a continually increasing standard of control and stability had been demanded. The nosewheel played some part in contributing to the improvement of stability through its influence on c.g. range, lending itself to a forward range giving greater margins.

In some cases control was reinforced by power boosting. The question of manual reversion which permitted no lower [illegible] the standard for slow-speed approach, had to be considered. If an aircraft had a natural buffet as it approached the stall, this was considered a good feature, but it was extraordinarily difficult to design it into the aircraft in the first place, and still more difficult to reproduce on a production series.

The piston engine was very satisfactory for deck landing: on the "cut" the response to closing the throttle was immediate, and the loss of slipstream velocity over the wing promoted the right conditions for the sink on to the deck. Turbines had introduced different circumstances, and there was a tendency for thrust to persist after the "cut".

The glide-path after the "cut" could be flat or steep, depending on aerodynamic variations. To achieve a flare-out just before contact excess lift was required, which meant that the glide-in speed must have a margin over the engine-off stalling speed. The steeper the glide the greater the excess lift, and, consequently, the faster the glide speed. If the flare-out was not made accurately, then the undercarriage shock-absorber system was called into play and if the gliding-angle was sufficiently steep to load-up the shock-absorbing mechanism unduly, trouble must be expected.

For the designer, the flat glide was the more attractive as it permitted the slowest approach and the easiest conditions for the flare-out, without too much demand on the shock-absorbing capacity if judgment erred. But it meant that the "cut" must be given at a point some distance aft of the stern, and this was more difficult for the batsman to judge, and made a wave-off more likely under rough-sea conditions. For both pilot and batsman it was preferable to have a steep glide-path after the "cut", so that the "cut" could be given close up to the stern, when the pitching of the deck would be less likely to interfere with the landing. The great thing, said Mr. Hollis Williams, was to build plenty of controllable drag into the flap system, and then this could be balanced during development by adjustments to residual thrust.

The tailwheel undercarriage had many natural advantages. This was realized only after the problems of the nosewheel aircraft had been solved. The stability of a tailwheel aircraft in a rolling ship, especially with backward wing-folding, was excellent. Towing ahead or astern was simple and controllable. There was no need to worry about the dynamic motion of the aircraft on its shock-absorber system, and because of the long wheelbase there were no important magnifications of movement. The attitude on the catapult was naturally correct, and the folded height was less of a problem. The tailwheel aircraft was reasonably good directionally for take-off; it was only the landing that required a certain accuracy of speed and altitude. In a misjudged landing, leading to bounce and float over the wires, the aircraft was usually gathered up safely by the crash-barrier.

The theory underlying the change from tailwheel to nosewheel, so that a first contact with the deck, ahead of the aircraft c.g., promoted an increased wing incidence, with tendency to bounce and float, whereas the first contact aft of the c.g., promoted a decrease in incidence, reduced lift and so lessened the tendency to bounce and float. The nosewheel undercarriage was primarily a device for reducing lift at the moment of contact, but it had other advantages, and some disadvantages. Some aerodynamic device for destroying the lift on a tailwheel undercarriage might eventually prove to be the right way of retaining the advantages and avoiding the disadvantages.

A naval aircraft might be stowed athwartships or in a tight park on deck, with its tail projecting over the side. It was essential that the aircraft should have stability on its nosewheel undercarriage up to the ship's maximum angle of roll, which might be as much as 20 deg. The stability on the undercarriage was mainly important in the folded condition, as the aircraft was never likely to be athwartships with wings spread.

The c.g. could be moved forward in the folded condition either by a forward component on the fold or, on jet aircraft, by a sort of "kneeling" position of the nosewheel. Because the base of the nosewheel undercarriage was relatively short, there were magnifications of movement at the tail. If the nosewheel oleo had spongey characteristics, a sudden check by brakes or chocks when moving the aircraft might increase the height of the tail by an amount proportional to the compression of the nose oleo.

A four-wheel undercarriage might be the right answer provided that the aircraft was stabilized positively one way or the other in the folded condition. An aircraft which just rocked about its main wheels on to its nosewheel or tailwheel in sympathy with the motion of the ship would impose an unacceptable limitation on parking arrangements.

The nosewheel undercarriage introduced problems on the catapult. It was desirable to cater for the catapult condition under normal static attitude of the aircraft. The machine should sit naturally on the deck with its wings at a positive angle of incidence and its tail low down—in fact, almost in landing attitude. If it had a zero-incidence attitude, then a forced attitude would be required on the catapult. This might require ancillary equipment and would, in any case, mean the loss of valuable seconds in loading and firing. It was possible for a nosewheel aircraft to come clear off the deck under sheer recoil of the undercarriage and, accordingly, the arrester gear must be sufficiently long to retain contact with the deck.

Mr. Hollis Williams described the development of arrester gear as "mainly a case of hammering on the test bench." The damping gear must be completely reliable to ensure that the hook was pressed down on the deck without bounce; it must follow the deck, whatever the motion of the aircraft, until it had picked up a wire. At present sting-type arresters were in favour, but perhaps at times the pilot would prefer his arrester hook not to be quite so far behind his sight-line, as on a large aircraft he progressed well towards the crash-barrier before feeling the satisfying drag of the arrester cable. Concerning wing folding, the lecturer said that

the system should help to stabilize the aircraft on its undercarriage under rough-sea conditions.

Power Plants.—In the second part of his lecture, Mr. Hollis Williams said that it had been normal to design naval aircraft around engines designed initially to R.A.F. requirements, and it would appear that there was no requirement for a power plant specifically for naval use. Between the wars, as engine power increased, attempts were made to break down the total power into self-contained units, so that the failure of one small accessory should not lead to total power failure. The Bugatti multi engine, the Fiat and Hispano double engines, and the small double Menasco were remembered. The Fairey Aviation Company had thought seriously about building contra-rotating airscrews for use with high-powered single engines and had the conviction, moreover, that everything possible should be done to save valuable crews, equipment and aircraft. This led to the idea of "duplicated power". Permissible folding dimensions were of the order of 13ft, and it was not possible to design an aircraft with twin, wing-mounted nacelles which would fold into such limited dimensions, even if the aircraft could be handled safely on one engine for an emergency deck-landing.

In 1935, Mr. A. G. Forsyth, the Fairey engine designer, proposed a double engine with each unit completely self-contained and delivering its power through one half of a co-axial airscrew. This was known as the P.24, and when cleared for prototype flight-testing it was mounted in a Fairey Battle. Under pressure of war the decision was taken not to go ahead with production in Great Britain, but the P.24-Battle was shipped out to America for assessment at Wright Field and created a profound impression. The engine comprised two 1,000 h.p. units. There were in America at that time several 2,000 h.p. engines, so steps were taken to develop the P.24 up to the 3,000 h.p. class, with a view to installing it in an operational fighter. The shock of Pearl Harbour, however, caused the emphasis to be transferred immediately to the mass-production of developed engines, and the project was shelved. It was, nevertheless, a highly promising venture, and the P.24 was probably the first engine designed specifically for naval requirements. The lecturer emphasized that there was no pressure from the Navy for such a development, the morale of naval pilots being then, as now, entirely proof against the prospect of an occasional ditching.

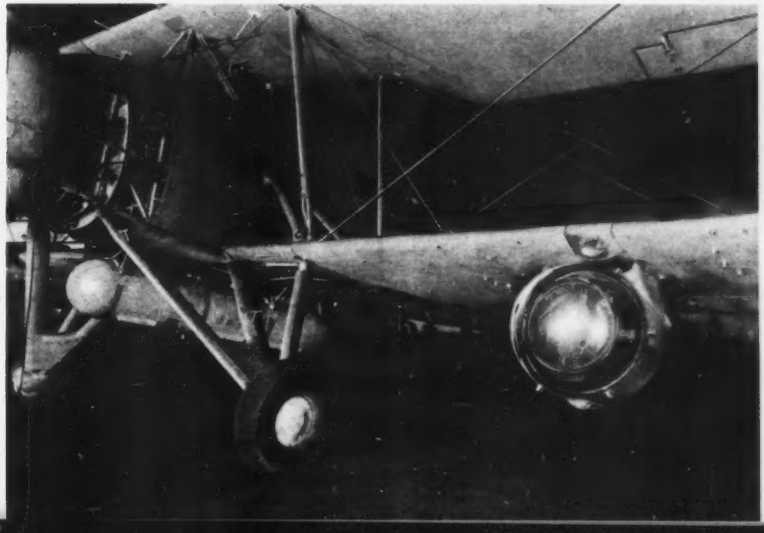
During the war developments with this line of thought were in abeyance until 1944. At that time the Fairey company was anxious to pack more power into one of its types, and H. E. Chaplin proposed a scheme based on two Merlin engines in tandem, with shaft drives to a special gearbox mounting a co-axial airscrew. Work was started on this development, but was not completed, because of the advent of the gas turbine.

Towards the end of the war the Fairey company was working on a projected naval strike-aircraft based on a turboprop unit, and difficulty was found in meeting the fuel-load requirements, both from the point of view of stowage and of the effect on total weight. It was realized that here was the outstanding reason for reverting to the double engine. The study of a typical turbine power/consumption curve showed that the specific consumption rose rapidly with throttling, and that it paid to operate the engine at, or near, full load. Thus, with the power derived from two independent units it would pay, under cruising conditions, to operate one unit close to full load, with the other shut down.

Discussions were held with Rolls-Royce and a double power plant was schemed, based on two large turboprops. The type was ordered and a considerable amount of design work, and some manufacture, was done over a period of some eighteen months. At that time, however, the engine-development programme was so over-loaded that some items had to be deleted, and unfortunately this double engine was considered to be of limited application and work was stopped.

It was generally considered unwise, said the lecturer, to associate a prototype engine with a prototype aircraft, though recent rapid developments in turbines had often made such a risk unavoidable. For the fighter aircraft the turbojet offered such overwhelming advantages that the choice had only to be made between the various types available. In the strike group the decision might rest with either the turbojet or the turboprop. In the anti-submarine group, with its free-take-off requirement, the choice fell between the piston engine and the turboprop. At about 3½ hr endurance, with allowances for warming up, take-off, climb, stand-off and so forth, the twin turboprop, plus fuel, balanced the weight of the single piston engine plus fuel. For 4 to 6 hr endurance the weight of the piston engine plus fuel was lighter than the weight of the twin turboprop plus fuel. For endurances of more than 6 hr it paid, on a weight basis, to compound the piston engine. The piston engine required high-octane fuel and was handicapped by the requirements for flame damping, which added weight and reduced power; but the balance was sufficiently close to make decision difficult. Had there been a piston engine of just the right size, with a margin in hand for development, it was probable that the Fairey company would have made a conservative selection in favour of the piston engine. As it happened, the only piston engine available in the weight/power class required held no particular promise for increase of power, and though it would have satisfied performance requirements for the anti-submarine type, at its starting weight, it was known from experience that all naval aircraft increased by at least 20 per cent in all-up weight, during their life. The Swordfish, operated at 40 per cent overload. It was necessary, therefore, to choose an engine, or engines, which had sufficient reserve to cope with this probable final weight.

The Fairey company was attracted, when considering the specialized anti-submarine requirements, to the Mamba turboprop. It was proposed to Armstrong Siddeley that two of these engines should be coupled and the full support of that company was secured. There was some doubt as to whether the right way to develop thrust was through a contra-rotating airscrew or co-axial airscrews. The contra-rotating airscrew meant clutches and free wheels, and introduced various unknown features, whereas, Fairey had had flight experience with the co-axial and were satisfied that no unpleasant surprises would result from such a development. Therefore, the company encouraged Armstrong Siddeley to go ahead with the co-axial arrangement and stressed the importance of retaining complete independence of power units. The engine as designed and developed had complete independence of gear trains and so on : the only point at which there was dependence was where the co-axial shafts rotated one within the other. The development units had given an extraordinarily good account of themselves, with long periods of maintenance-free running. At the moment, they were sensitive to starting-up conditions, either on the ground or in the air, and a false start would give a rapid temperature rise, which might cause trouble. This would mean further development and the introduction of automatic means to avoid such critical conditions. Prototypes had been brought home with one turbine shut down; they might otherwise have been damaged in forced landings.



Fairey Swordfish fitted experimentally with a Leigh light under the port lower mainplane. The faired object under the fuselage is the battery.

(Left) Fairey Battle, with Fairey P.24 double engine. (Right) Fairey 17 anti-submarine aircraft, with Armstrong Siddeley Double Mamba.

NAVAL-AIRCRAFT DESIGN . . .

The great virtue of the double engine for naval use was that all the power was on the centre-line of the aircraft. With the increased folded dimensions permitted in the larger modern carriers it was possible to have engine nacelles on the wings and to provide aerodynamic arrangements and control which enabled such an aircraft to be handled on one engine. But deck-landing on one engine with a conventional "twin" must always involve difficult handling problems for the pilot, whereas, with the double engine, provided that the operative unit had sufficient power to give the slow-speed, engine-on approach, deck-landing on one engine was no longer in the emergency category.

Turbines had solved the flame-damping problem, which had been a perpetual nuisance with the reciprocating engine, and already "side-line" advantages were showing up which weighed the balance in favour of the turbine. Noise level was relatively low, which increased the efficiency of radio and intercommunication. Vibration also tended to be low, thereby improving the serviceability of instruments, radar and radio. Since this group of electrical equipment tended to give the highest percentage of unserviceability, this was a tremendous achievement. Both turbojets and turboprops gave great flexibility in the choice of fuel and, although more fuel was burnt, the absence of high-octane petrol simplified the storage problem for the carrier.

Anti-submarine Operations.—In the First World War anti-submarine operations by aircraft were mainly restricted to attacks by bomb and machine gun on submarines either surfaced or at periscope depth. Between the wars progress was mainly in the development of special anti-submarine bombs and mines. At the start of the Second World War the Swordfish was the operational carrier-borne anti-submarine aircraft, and the first specialized item of anti-submarine equipment, apart from droppable stores, was the Leigh light, mounted under the lower wing, by which it was hoped to surprise surfaced enemy submarines at night. This in turn, was followed by the fitment of radar, and in due course the strike effect was augmented by rockets, etc.

In all the aircraft used, the anti-submarine rôle was subsidiary. Towards the end of the war, however, and during subsequent years, important developments had taken place in both search and strike equipment, and it remained to produce a specialized aircraft to make the best use of these developments. One solution was the Fairey 17 combined search and strike anti-submarine aircraft. This particular type was remarkable for the small degree of compromise. The starting point was the decision to use a double power plant based on two single Mambas. The engine designers agreed to design around any geometrical arrangement of engines, gearbox and airscrew shafts that were required, if this were practically possible, and so the Fairey company was in the unusual position of being able to prescribe what virtually amounted to a tailormade engine. There was thus no compromise on pilot's view, and there was certainly no compromise possible on power plant. Had the Double Mamba failed to appear on time, no other engine or engines could have been substituted, short of a complete re-design forward of the front spar. It was only the profound conviction that the solution proposed was right (in view of previous experience with the P.24) which made the company take the risk to get the 100 per cent solution. The picture looked fairly gloomy at times, while the engine-development team was struggling with the usual troubles; but the first unit arrived in time for the aircraft which, as usual was also late as a result of its own particular problems on final assembly.

Turbojets and turboprops had already gained a reputation for requiring little maintenance, and this was fully exploited by installing the Double Mamba in a tunnel under the pilot's cockpit floor, with a slight compromise on accessibility. It was obvious that from time to time full access would be required, so a scheme was evolved for rapid extraction of the power plant.

The Double Mamba was provided with a front pair of detachable rollers and a rear pair of rollers, permanently mounted. The rear rollers rested on rails built into the structure. For removal, a pair of ancillary guide rails were attached at their rear ends to the bulkheads and their forward ends were mounted on a large ancillary supporting bracket which, in turn, was anchored on the fixed part of the nosewheel shock-absorber. The engine gearbox had cast lugs which received the front pair of rollers and, by means of a hand-operated ratchet, the whole power plant could be run forward, once the connections had been cast off. This scheme had the virtue that it was self-contained on the aircraft. The ancillary gear was light and small enough to be carried in the machine, and the operation was independent of shock-absorber compression, so that the aircraft did not have to be jacked-up and trestled. Only if the power plant had to be lifted from the guide rails was a prop necessary under the tail.

The one compromise was on the positioning of the radar. This was mounted retractably at the rear end of the bomb-bay—the only place in an aircraft of this layout. The perfect position was right at the front, below the nose, which would have meant a conventional twin-engined machine.

Aerodynamic design of the Fairey 17, with regard to wing areas, tail volumes and so on, was based on the continuous rating of one Mamba. To keep down the folded height, and to give stability when stowed, a double wing-fold was used with a view to keeping the folded c.g. as low as possible. As a contribution towards aerodynamic cleanness, a suppressed flap-hinge system was used for the first time in a Fairey aircraft. The low position of the tail in the "standing" attitude gave ample margin on hangar-roof clearance for any emergency such as a collapsed nose oleo, or simply through the dynamic effects of sudden check when the aircraft was being rolled into position in the hangar.

It would be noted in the side view of the aircraft, in its normal static position, that it was mounted on its undercarriage at a positive angle of incidence—in fact, almost at landing attitude. The object of this was to favour catapulting conditions so that at the end of the stroke the aircraft would be very near the appropriate incidence for flight without artificial aids. Such a nose-up, tail-down, attitude had to be considered in relation to the landing operation; it would be realized that it brought the nosewheel into action during the course of a normal landing much earlier than was customary with nosewheel undercarriages. This, it was suggested, was a good feature if not overdone. The aircraft had little opportunity to acquire angular momentum on the pitch forward, and there was a speed or attitude at which it would do an actual three-pointer. There was a general tendency to spread the load on to all three shock-absorbers, giving a very useful reserve margin of shock-absorption and strength. If the nose-up attitude were overdone, it would mean that, with excess speed, or a last-minute, nose-down, change of attitude, the condition of a first contact forward of the c.g. would arise. So correct judgment must be made as to how far it was safe to go in this direction.

The design of the Fairey 17 nosewheel called for comment. The twin-nosewheel arrangement was governed by the space available. Geometrical limitations made it impossible to provide a vertical nose oleo, which would have led to a simple castering bearing in its base. Experiments with nose and tail towing of models showed that the angle of this caster bearing was critical, and so an offset bearing had to be provided at the bottom end of the oleo. One problem was to avoid nosewheel shimmy and to arrange a free caster for slow-speed handling, manœuvring and towing. The solution used limited the freedom of the caster for take-off, landing and retraction, and freed it for slow-speed handling.

The strength of the airframe structure was obtained by mechanical-test development. The lecturer recalled that some years ago his company had been required to increase the load factors on one of its types by some 10 per cent, which seemed a formidable task. The strength of the type had been arrived at by calculation, and then the completed aircraft was put up for test and carried the design load successfully. When the computation of the effect of the increased factor was completed, to the lecturer's amazement he found that a very short list of modifications would give the desired improvement. The whole structure, in fact, was much stronger than it need have been, apart from those few items which had been designed right down to calculated loads. For the Fairey 17, therefore, it was decided to develop the required strength by actual

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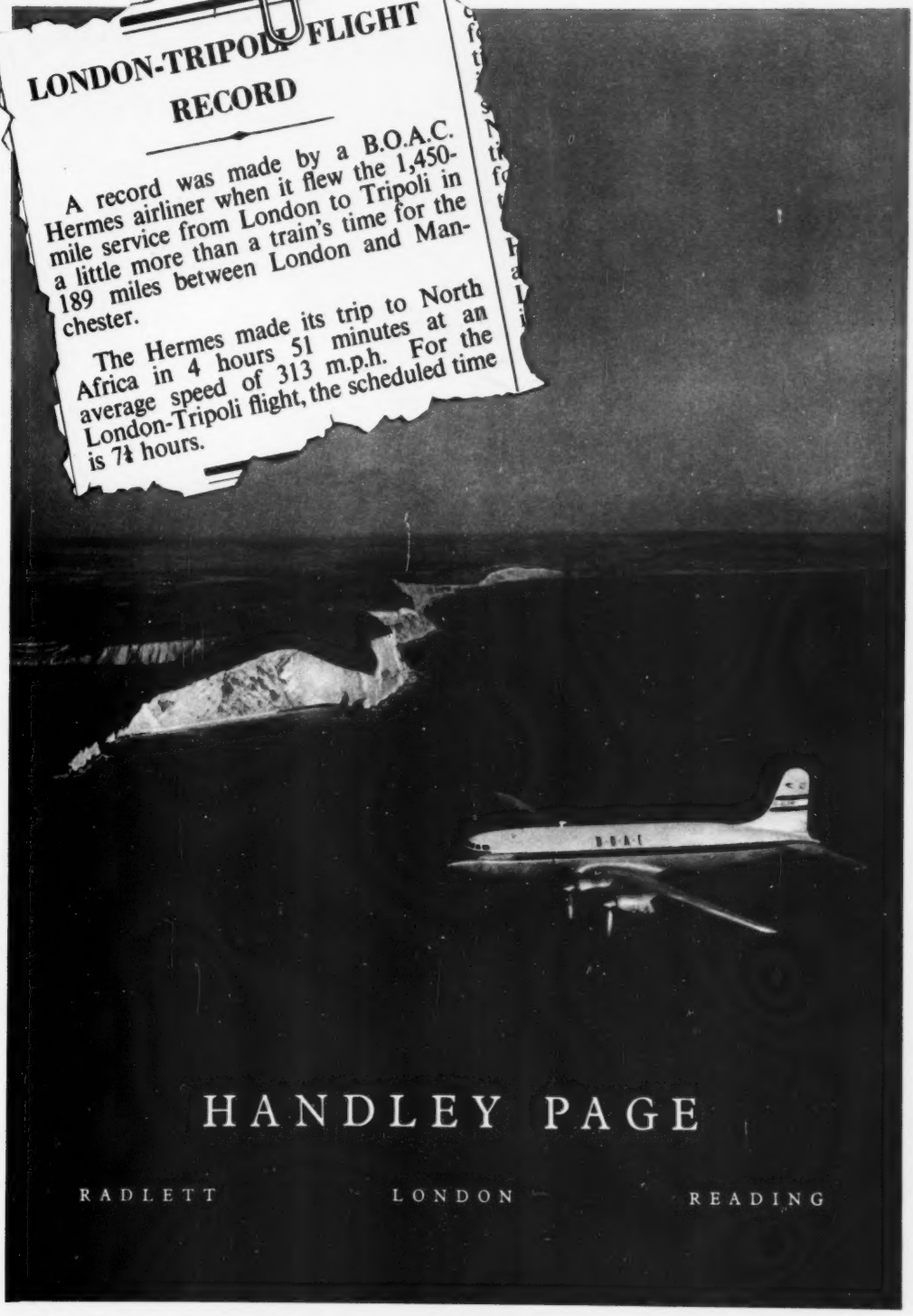

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testing. The method by which this was achieved was to base the strength calculations on an early weight estimate and take no account of those fluctuations in total weight which occurred during the design of any aircraft. The airframe was finally put up for structural test with a load distribution based on the actual total weight which the finished aircraft would have. A few local points had to be strengthened, but in due course the airframe was cleared without undue difficulty, and with very satisfactory results as far as structure-weight was concerned. The lecturer's opinion was that this was the most satisfactory method of obtaining a light and efficient structure.

The flywheel effect of a turbine, said Mr. Hollis Williams, was considerable, and after shutting the throttle there was an appreciable delay before the turbine lost speed. Again, on the open-up—as in a wave-off—it was found that delay in picking up speed was again appreciable. Armstrong Siddeley Motors, Ltd., had made experiments with a single Mamba, fitted with a Rotol airscrew, in a Balliol trainer. This used a constant-speeding system, whereby the turbine was run continuously at constant speed, and variations of thrust were achieved by airscrew-pitch change. The system of control was reported upon most favourably, and, therefore, was introduced into the Double Mamba power plant. By running the turbines at constant-speeding condition when throttling for landing, the flight fine-pitch stops were withdrawn and the airscrew blades were free to take up whatever fine pitch was necessary to satisfy the minimum shaft h.p. In other words, at the "cut", with the turbines running at constant speed, the airscrew approached its ground fine pitch stop. It must be realized that to satisfy starting conditions the turbine fine-pitch setting was much nearer the discing condition thanwas the case with a piston engine.

The constant-speeding system gave a satisfactory rate of thrust-loss at the "cut", and at gliding speed entered a condition of negative thrust which provided a useful increment of drag.

Of the further development of the anti-submarine aircraft, the author said that those who had been studying anti-submarine warfare realized that the fixed-wing aircraft, in due course, might give way to the helicopter. A large, load-carrying, all-weather helicopter could solve a number of problems in a much simpler fashion than was possible with a fixed-wing machine. It would not only simplify equipment, but it should be possible for it to operate from a merchant ship, thus removing the necessity for the escort carrier, itself an important and vulnerable target.

THE INDUSTRY ANALYSED

Aircraft Manufacture in 1935 and 1948 Compared: B.O.T. Census Figures

BOTH to those who find such data of value in their work and to others who like statistics for their own sake, an analysis of the British aircraft industry recently issued by the Board of Trade should be of considerable interest. Extracted from the production census on which the B.O.T. has been engaged, it is published in *The Board of Trade Journal* for March 24th as preliminary report No. 139: *Aircraft Manufacture and Repair Trade*.

The report consists of five tables in which each important aspect of the subject is covered comparatively, the census year 1948 being set against 1935. The choice of these two years—which, presumably, applies throughout the industrial census—is interesting in view of the fact that in each case a rearmament expansion was about to begin.

In a brief introduction to the tables, the Board explains that they refer to "establishments engaged wholly or mainly in the manufacture and repair of complete aircraft (including gliders, airships and balloons) and frames, and of engines of all types, propellers, undercarriages, and other parts and accessories (except electrical equipment), and which employed more than ten persons on the average during the year."

It is estimated that about 99 per cent of the total net output of these establishments for 1948 is covered by the returns compiled.

It is further stated that "any establishments in Northern Ireland are excluded in 1948; no production was recorded there in this trade for 1935." (It will be recalled that Short Bros. did not move from Rochester to Belfast until after the war.)

Though we do not intend to discuss the figures here, some are particularly worthy of note—as, for example, the revelation that the net value of output per person employed rose from £241 in 1935 to £514 in 1948.

Taken literally, a footnote to Table V is amusing—"No working proprietors were recorded for 1948." It would be enlightening to hear, say, Sir Frederick Handley Page's comments on this.

TABLE I: GENERAL SUMMARY

	1948	1935
	(£ × 1,000)	(£ × 1,000)
Value of production (gross output)	115,294	14,328
Receipts from Government Departments	2,676	—
Cost of materials, fuel and electricity used ...	42,619	5,391
Amount paid for work given out	6,321	270
Net output	69,030	8,667
Wages and salaries of persons employed	49,530	—
Average number of persons employed (excluding outworkers)	134,219	35,890
Net value of output per person employed (excluding outworkers) (£)	514	241
Number of establishments	192	57

The values of production in 1948 and 1935 and of materials, fuel and electricity used in 1948 are derived in the following manner:—

	Output		*Materials, etc.*
	1948	1935	1948
	(£ × 1,000)	(£ × 1,000)	(£ × 1,000)
Total value of sales or purchases ..	111,673	13,029 (a)	43,522
Adjustments for stocks and work in progress	+3,775	+1,299 (b)	—903
	115,448	14,328	42,619
Less payment for transport by other firms	154		
	115,294		

(a) Production for sale. (b) Work in progress only.

II: STOCKS OF FINISHED PRODUCTS, MATERIALS AND FUEL

	Beginning of Year		*End of year*	
	1948	1935	1948	1935
Finished products and work in progress (£ × 1,000)	58,638	2,748(a)	62,413	4,047(a)
Materials and fuel (£ × 1,000)	10,722	...	11,625	...

(a) Work in progress only.

III: CAPITAL EXPENDITURE—PLANT, MACHINERY, VEHICLES

	Acquired during 1948		*Disposed of during 1948*
	New	*Second-hand*	
Plant and machinery (£ × 1,000) ...	1,516	1,308	211
Vehicles (£ × 1,000)	180	114	44
Total (£ × 1,000)	1,696	1,422	255

IV: CAPITAL EXPENDITURE—NEW BUILDINGS ACQUIRED

	1948
Capital cost of new buildings (including extensions, etc.) acquired during the year, excluding site value (£ × 1,000)	758

V: EMPLOYMENT, WAGES AND SALARIES

	Operatives (av. for year)		*Admin., tech. and clerical staff (a)*		*Totals*	
	1948	1935	1948	1935	1948	1935
No. of males:						
Under 18	2,659	3,129	663	417	3,322	3,546
All ages	85,250	28,266	29,411	4,719	114,661	32,985
No. of females:						
Under 18	224	270	1,131	261	1,355	531
All ages	8,879	1,687	10,689	1,218	19,558	2,905
Total Nos.:						
Under 18	2,883	3,399	1,794	678	4,677	4,077
All ages	94,129	29,953	40,090 (b)	5,937	134,219(b)(c)	35,890
Total remuneration (£ × 1,000)	32,975	—	16,555	—	49,530	—

(a) At September 25, 1948 and October 12, 1935.
(b) No working proprietors were recorded for 1948.
(c) The employers' share of contributions to all National Insurance Schemes payable during the year in respect of these workers amounted to £1,056,000.

In addition to the employees in the above table the firms in this trade employed 9 male outworkers in 1948, the amount paid to them being less than £500. Similar information is not available for 1935.

CIVIL AVIATION

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THE DEBATE IN THE COMMONS

MUCH of what was stated and discussed in the course of the debate on civil aviation—which took place in the House of Commons immediately before Easter—was of general interest, and many opinions and answers to questions are worthy of close examination and consideration. Reference was made to certain salient points in our leading article last week, and we now report more fully the speeches and views of many members who took part in the debate.

MR. GEORGE WARD (Worcester), who is a prominent officer in the Conservative Party's committees and sub-committees concerned with civil and military aviation, was the first speaker. He said that he would begin with one or two points, criticisms and suggestions regarding the Corporations' accounts, though before doing so he thought it only fair to give praise where praise was due. Whatever one might say about the administration or the economics of the two State-owned Corporations, there was no doubt that their standards of skill and safety in the air were unrivalled by any of their competitors and were well worthy of the proud traditions of this country, whether on land or sea, or in the air.

Secondly, he thought that a study of the Corporations' accounts for the year ending March, 1950, left no doubt that both Corporations had made real efforts to effect economies and increase their efficiency. Certainly it was a matter for congratulation that B.E.A. started their economy drive by reducing the salary of their chief executive from £4,500 a year to £3,200. It was disappointing, therefore, that while B.E.A. had halved their losses as compared with the previous year, B.O.A.C.'s total deficit showed very little improvement. He agreed that their operating account showed a reduction in deficit of £673,000, but that was almost entirely due to the improvement in the Eastern Division after their Yorks had been replaced by Argonauts—a satisfactory justification for those who had advocated the purchase of these Canadian aircraft.

While it was encouraging that both airlines showed a reduction in their operating costs, it would appear that there was room for still further improvement. B.O.A.C.'s operating costs were 54.4d per capacity ton-mile while those of Pan-American were only 30.7d at the old rate of exchange, or 44.1d at the new rate, although we knew that American costs of labour were very much higher than ours. Again, Pan-American produced 19,500 capacity ton-miles per employee, which was nearly three times the productivity of B.O.A.C. It would appear that B.O.A.C.'s administrative costs were still too high. General administration was 13.1 per cent of their total costs as compared with 8.1 per cent shown by Pan-American.

One was obliged to speak in these matters largely at second hand, but those who took an interest in them from time to time still received reports of apparently unnecessary overstaffing at the various stations in B.O.A.C.'s network. He felt that more could be done in the way of putting out to private tender many of the services, such as catering, which were at present operated by the Corporation. There also appeared to be considerable overlapping both of administration at all levels and of labour with the employees of the Ministry of Civil Aviation. For example, airports in this country had at present an airport manager and an airport commandant, both under the M.C.A., and a station superintendent under the airline concerned; and the handling of passengers and baggage also seemed to be duplicated in many unnecessary ways.

Turning to B.E.A., Mr. Ward said that a comparison of their operating costs with those of other airlines was rather more difficult and, therefore, likely to be less accurate, but Aer Lingus, K.L.M., Air France and Swissair all showed in 1949 lower costs per capacity ton-mile than B.E.A. Of course, B.E.A.'s main handicap was the internal services. The low average flight-stage of only 113 miles was bound to affect utilization rates and send up costs; and things were made no easier for them by the absurdly high landing fees chargeable at home airports. For every £100 earned by internal services in the year under review £9 was spent on landing fees in this country, while on Continental services the figure was only £3.

Then there was the fuel tax, chargeable only on the internal services. In the year under review fuel tax cost them £85,000 and this year it was estimated that the increased tax would cost well over £200,000. Continental services were exempt from this tax; why should not internal services also be exempt? Mr. Ward did not think it over-simplification to say that if these services were made to pay it would be unnecessary to collect so much taxation from the public in order to meet their losses.

Regarding the administration of the Corporation, he hoped that the move of B.E.A. from Northolt to Heathrow would permit further economies. For example, it would surely no longer be necessary for each airline to run a separate 'bus service between London and Heathrow. There should also be a reduction in administrative and other airport costs as a result of the removal.

Mr. Ward said that Mr. Masefield, the chief executive of B.E.A., to whom that Corporation owed so much of its increased efficiency, had stated in a recent Lecture to the Institute of Transport that the optimum size of any airline was probably reached when that airline was able to provide 120 million capacity ton-miles a year. If the airline was bigger than that, its efficiency, particularly as measured in costs, would begin to decrease. According to B.O.A.C.'s accounts for the year ending March, 1950, their total of available capacity ton-miles amounted to 122 million.

Ever since the amalgamation of B.O.A.C. with B.S.A.A., and even before that, Mr. Ward had strongly held the opinion that B.O.A.C. was too big and unwieldy ever to be really efficient. Its network spanned the world and it had in addition five subsidiary and nine associated companies. During the second reading of the Air Corporations Bill in June, 1949, he had ventured to put forward a suggestion that there should be an Atlantic Corporation, an Empire Corporation, and a European Corporation. He had pointed out that such an arrangement would make possible the concentration of very-long-range aircraft in one Corporation, fairly long and medium-range types in another and short-range aircraft in a third.

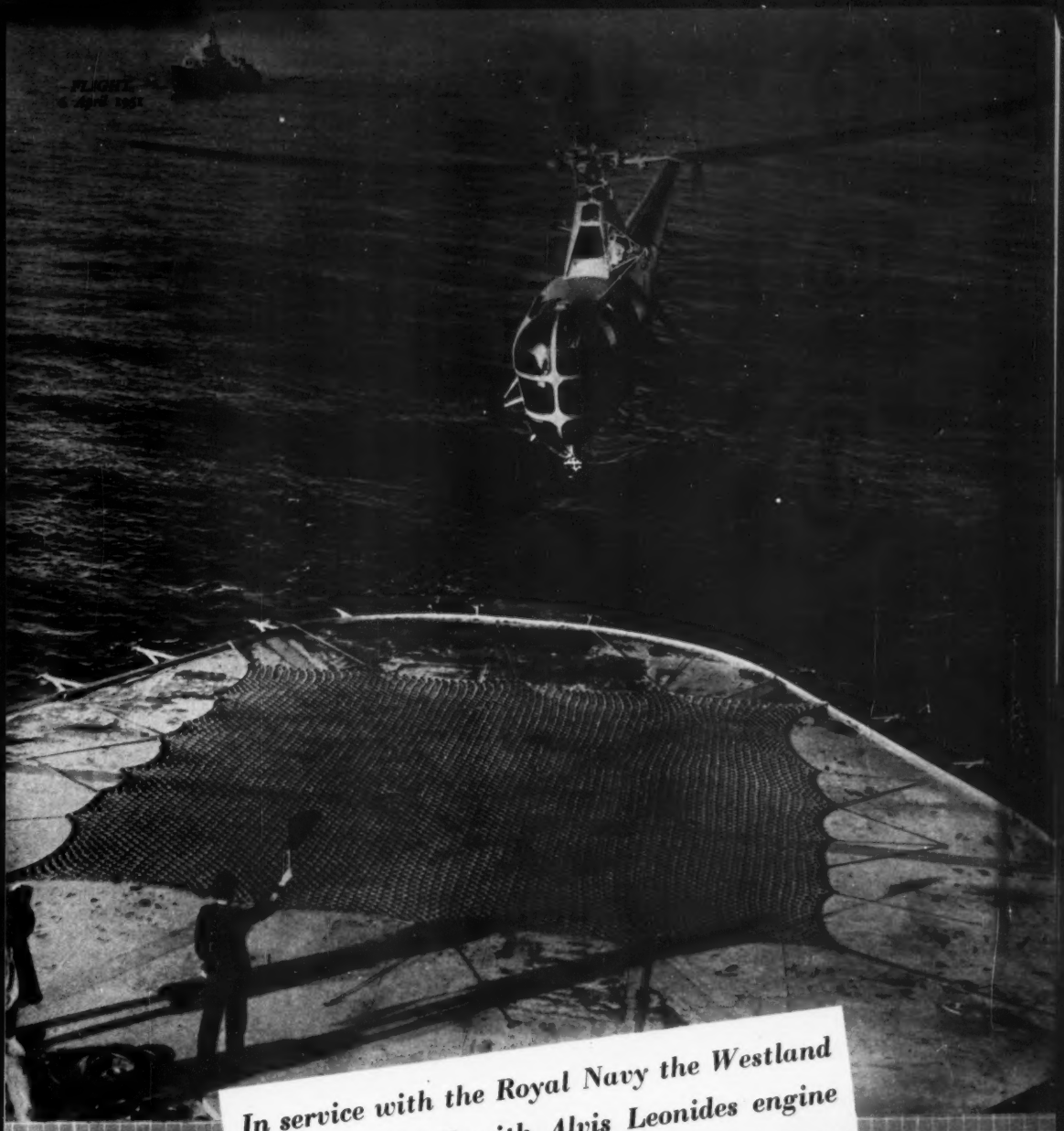
Turning to the independent operators, Mr. Ward said that two important questions arose. The first was, what exactly was a scheduled journey? The second, would the Corporations not be in a position to compete unfairly with the charter companies by using the resources of the State to the disadvantage of the independent operators?

The first point was met by defining in the Act a regular scheduled journey, thus by implication leaving all other services open to private operators. Mr. Ward read that definition in the Act. It was stated, in Section 23(2) :—

> "In this Act the expression 'Scheduled Journey' means one of a series of journeys which are undertaken between the same two places and which together amount to a systematic service operated in such a manner that the benefits thereof are available to members of the public from time to time seeking to take advantage of it."

He asked the House to note particularly that availability to the public was a condition for a scheduled journey; and, therefore, any journey, however repetitive, which was not available to the public was not a scheduled journey under the Act.

If there was any doubt on this point the proper place to have it decided and to have that definition interpreted was in the courts of law. But without reference to the courts, the Minister of Civil



In service with the Royal Navy the Westland Dragonfly fitted with Alvis Leonides engine

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Getting Cracking . . .

WE all know about oil. We've seen it on the movies. There's this fellow whatsisname—a Gary Cooper type—weary and lean-jawed, and there's a blonde in a check shirt in the offing. And one fine technicoloured day, after years and years of failure, privation and squalor . . . whoops ! Up she comes. There he is, our hero —his rows of white teeth gleaming in blackened, oil-soaked features—running for a marriage licence. That's oil.

Well, isn't it ? They pump the stuff from Nature's underground reservoirs, label it petrol, gasoline or juice and bury it again under garages and airports. They do the same with gold, don't they ? Unearth it in South Africa and bury it at great expense on the other side of the world. Right ?

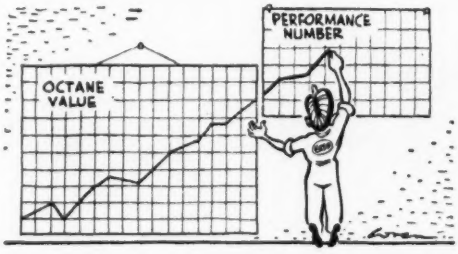
Not quite ; we're forgetting something. We're forgetting that crude oil is crude. We're forgetting chewing gum, candles, insecticides, explosives, inks, paints, synthetic rubber, diesel fuels, asphalt, lubricating oils, salves, creams, ointments, tractor fuels, jet fuels . . . *motor spirit*, AVIATION FUELS . . . and a thousand other things. No, the oil industry isn't merely a super transport organisation charged with the task of moving oil from well to consumer by means of fine fleets of tankers, tank cars and pipe-lines : it's a dozen industries

in one, and its chief job is to convert crude oils into fuels of maximum efficiency for every type of engine.

Think of an octane number . . . double it . . . double it again. That's roughly what the industry's been up to these last few years. It has recently produced aviation fuels so high in anti-knock value that they ran right off the octane* scale and met up with a new yardstick, PN or Performance Number. And the work of tailoring fuels to fit engines and engines to fit fuels goes on, and on. The engineers, scientists, technologists and physicists of the oil industry sit in their laboratories and think of a performance number . . . double it. . . .

No, it's not just a matter of emptying wells and filling pumps.

What is the oil industry doing in Britain ? Answer—the biggest job in its history. What are ESSO doing ?



Answer—their biggest job ever. In this country we're now using about seventeen million tons of oil products a year. Nearly all of this oil is imported—from the Caribbean and increasingly from the Middle East—and half of it was refined overseas. But soon, two years from now, when the industry's £125,000,000 building programme has been largely completed, the country will be independent of refineries abroad.

Production at British refineries and cracking plants will be something like twenty million tons of petroleum products a year. *It was three and a half million in 1948.*

One single unit of the industry will be responsible for more than a quarter of this vast output—Esso's giant refinery, now half built, at Fawley, near Southampton. This plant, built and financed entirely by private enterprise, is now expected to go "on stream" towards the end of 1951 with an ultimate annual output of over 6,000,000 tons of petroleum products.

All this in our tight little island where, as somebody said, there isn't room to swing a catalytic cracking unit.

It pays to say

ESSO

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* The octane or grade number of a fuel is simply the measure of its ability to resist detonation. The more compression a fuel can withstand without knocking when fired in the cylinder of an engine the higher its octane rating.

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CIVIL AVIATION . . .

Aviation, speaking in another place, had declared that the State Corporations regarded any repetitive service, whether readily available to the public or not, as their lawful entitlement, and that with his support and encouragement they would use their resources to compete for them. He had gone on to say that if the intention of the Act were persistently thwarted, it would create a position which the Government could not accept. Mr. Ward maintained, as did independent operators, that the intention of the Act was perfectly clear and was not being thwarted; and that to throw doubt upon that definition without having it decided in the courts was to put the charter companies into a hopeless position.

His second question—would not the Corporations be in a position to compete unfairly?—had been met during the passage of the Act by a definite assurance by the then Minister, Lord Winster, that they would not be allowed to use the resources of the State to the disadvantage of the private operator. But there was to-day abundant evidence that the Corporations were in fact using their subsidy and their privileged position under the Act of 1946 to try to drive the independent operators out of business.

Corporation Charter Work

Dealing first with the question of subsidy, Mr. Ward said that on page 43 of the accounts of B.O.A.C. for the year ended March, 1950, no operating overheads had been charged to "other than scheduled services"—that was, charter work. But how was it possible to undertake six million capacity ton-miles of charter work without incurring any overhead expenses? Perhaps the Parliamentary Secretary could explain it, but he was bound to say that it looked very much as though the overhead expenses incurred in competing in such work against the independent operators had been charged up to the regular scheduled lines. In that case the subsidy had been used to finance charter work and give a wholly unfair advantage to the State monopolies. He understood also that certain York aircraft had been set aside by B.O.A.C. for charter work. As the cost of operating Yorks for passenger transport was known to be not less than 12s 6d per mile, it was very difficult to see how the Corporation could possibly compete against charter companies without using their subsidy.

Justifying his charge that the Corporations were using their privileged position unfairly, Mr. Ward said that we had the example of the contract recently awarded to B.O.A.C. for carrying families of Service personnel to Egypt. The Corporation was carrying out that contract with Stratocruisers, which were bought for dollars for use on the Atlantic routes. The operating costs of these very large aircraft were so high that it would be impossible for the Corporation to have submitted the lowest tender on the same terms as the charter companies. But the point was that the independent operators were not allowed by law to advertise for fare-paying passengers for the return journey. They had to be lucky enough to find someone who would charter the whole aircraft. The Corporation could, on the other hand, under the terms of the Act, advertise for passengers and sell tickets seat by seat to any fare-paying passengers just as though it were a regular scheduled service. That naturally gave them a tremendous advantage.

There were several other examples of preference given to B.O.A.C. by Government departments and other public bodies, such as the Overseas Food Corporation, although private operators had often been able to submit the lowest tenders. All this was entirely contrary to the pledges given during the passage of the Act by Lord Winster.

Associate Agreements

Then there were the associate agreements with B.E.A. This scheme had been announced with a tremendous fanfare of trumpets as though the Crown jewels were being bestowed by the Corporation upon the charter companies. But when it came to the point, all the five-year agreements—the only ones which made it possible to buy new aircraft—were in respect of those routes on which there was very little chance indeed of getting enough traffic to make the service pay.

For the past four years, Airwork, Ltd., one of our largest and most reputable private operators, had tried to get an associate agreement with the Corporation to run a service to Basle at fares well below the cost of second-class rail travel. Although B.E.A. did not themselves run a regular service to Basle, and although this application offered unprecedented opportunities for travel at very cheap rates, Airwork's application had been consistently turned down year after year. For several years B.O.A.C. had been passing on to foreign airlines, rather than to British independent operators, the surplus passengers or freight which they themselves could not carry on their own services. Why were not our own people given a chance to carry this traffic, unless it was that the Corporations deliberately wanted to drive the British private operators out of business?

Mr. Ward had no doubt that other similar examples could be produced, but there was no doubt whatever in his mind that the charter companies were getting a very raw deal indeed, and it was remarkable that so many of them had been able to survive.

He then touched briefly on private flying, i.e., club pilots and private owners. They, too, were slowly being squeezed out of the air, as the following figures showed. In the first nine months of 1939, the Royal Aero Club issued 3,287 private pilots' licences; in 1946, the number issued was 1,688; in 1947, it was 1,763, and in 1948, 1,784. So far, it would be noted, the figures had been gradually increasing since the end of the war. In the last nine months of 1949, however, only 470 were issued, and in the first six months of 1950 the figure had dropped as low as 128. There was clearly a variety of reasons for this alarming drop in the number of private flyers, but he thought it significant that the first really big drop took place in 1949; because that was the year when the Air Navigation Order, of 1949, came into force. This order really did make the lives of private flyers almost impossible by producing a mass of rules, regulations and restrictions. He begged the Minister to look at this Order again and see whether it could not be simplified.

MR. FRANK BESWICK, Parliamentary Secretary to the Ministry of Civil Aviation, said that he repudiated immediately the suggestion that the Corporations about which Mr. Ward spoke were not subject to any competition. It seemed to him that air transport was one of the industries subject at this moment to the keenest competition. He spent some part of the Parliamentary recess last year in going round the South American continent and was amazed at some of the cut-throat tactics employed by the competing airlines in that part of the world.

Mr. Beswick said that within a week of his taking office he had given an explanation of the higher-than-estimated deficit of B.O.A.C. by detailing the unfortunate experiences with the Tudor; the effect of devaluation; the delays with new aircraft, and the difficult trading position in South America. He had also said, however, that the Corporation was determined to do everything in its power to keep down costs and to increase business. He was glad to say that the efforts of all in B.O.A.C. had resulted in a radically changed financial picture by the end of 1950.

Recent B.O.A.C. Statistics

Mr. Beswick then proceeded to indicate some of the available figures to bring the information Mr. Ward had given a little more up to date than the accounts terminating in March of last year. The passenger-miles flown by B.O.A.C. in the 12 months ended January, 1951, totalled 555 million, compared with 410 million for the previous 12 months. In the year up to January, 1951, the output per employee in capacity ton-miles, was 9,250 against 6,750, which he thought was the figure which Mr. Ward had to quote. The number of employees had been falling steadily. In April, 1948, it was 23,600 and in January, 1951, it was 15,600. The revenue earned per employee for the year ended January, 1951, was £1,350, compared with £900 for the previous 12 months.

Mr. Ward here interposed that the recent figure of productivity for B.O.A.C. of 9,250 capacity ton-miles per employee was still 10,000 capacity ton-miles behind Pan-American.

Mr. Beswick said that the importance of the comparison which he was making was that it showed the trend within our own Corporation. That was a fair comparison to make. The operating deficit for the 12 months ending January, 1951, was just under £5 million, compared with just under £8 million for the previous 12 months. That was the overall deficit. The operating revenue had gone up from £19 million for the year ending January, 1950, to £23 million for the year ending January, 1951.

As an indication of the effect upon the economics of this Corporation Mr. Beswick pointed out that they now broke even at a load factor, in January, 1951, of 75 per cent, compared with a load factor of 92 per cent in January, 1950; that was to say, if they could get all their aircraft three-quarters full, with operating costs as at January, 1951, they would break even.

For B.O.A.C., in the period ending December, 1951, operating costs per capacity ton-mile were 44.2d. Compared with previous years, the figure showed a marked decline. In the year 1946-47 the figure was 70.9d. In any case, he thought we could claim that the trend was a sharp one, and that it was in the right direction.

Mr. Beswick concluded this portion of his statement with a word of warning: the progress and the improvements in financial results had been achieved in the teeth of higher working costs, and within the next few months when newer and more advanced types of aircraft were introduced, the costs of such introduction would inevitably be high and in the short term might affect the present favourable financial trend; but he felt that the money invested in the introduction of turboprop and turbojet aircraft like the Viscount and the Comet would not only prove a good investment for the Corporation itself but for aviation as a whole.

The next subjects referred to by Mr. Beswick were air-traffic control and facilities at airports. Out of a total of 7,600 staff of

CIVIL AVIATION . . .

the Ministry of Civil Aviation, 7,000 were engaged on these duties. Scheduled traffic in the London area was at the moment almost wholly confined to London Airport and Northolt, he said. This year B.E.A. would begin to use London Airport for their Ambassador services, and gradually their services would be transferred from Northolt either to London Airport or to an alternative, and the transfer would be completed probably by the end of 1955. Meanwhile the work of developing London Airport had proceeded and £8,500,000 had been spent to date on building and civil engineering works there.

Corporation "Competition"

Following this statement the first part of a prolonged discussion upon the subject of non-scheduled services operated by the Corporations started to develop. In answer to MR. G. WARD, MR. BESWICK said that such work would be incidental, not the main business of the Corporations, and if they entered into it they would not be employing their subsidy unfairly to compete against private operators. There were occasions when it was in the interests of the Corporation, in order to keep down its overheads, to employ in the off-season aircraft needed for seasonal traffic, and which if not employed on non-scheduled business would be wasted at some periods of the year.

Mr. Ward said that he could not understand Mr. Beswick's arguments—although the spirit of the Act said to the contrary, as agreed by the Minister of Civil Aviation of the day, and although specific assurances were given that the Corporations would not use their subsidy to compete against independent operators and would not use their position under the Act to do so, the Minister now submitted that they were perfectly justified in doing that. The principle was either right or wrong. If it was wrong, they should not be doing it by using their Stratocruisers as far as Egypt and then advertising seats on the way back to capture traffic from private operators. It was perfectly clear that if the subsidy was to be used to compete against the private independent operators, the Corporation was going to have an unfair advantage.

Mr. Beswick replied that he thought the test in this matter would be that if a particular charter operation resulted in an additional liability upon the taxpayer, then he would agree that the Corporations were embarking on business contrary both to the letter and the spirit of the Act; but if the Corporations took on a contract which had the result of reducing their subsidy and which therefore was not utilizing the subsidy to enable them to compete with other operators, then such an operation, he would say, was not contrary either to the letter or the spirit of the Act.

Answering A. CDRE. HARVEY's question as to whether he could assure the House that every charter operation carried out by the Corporations had been carried out at a profit, Mr. Beswick said obviously he could not at that moment give an undertaking of that kind in respect of every individual case.

Scottish Affairs

At this point in the debate this argument was dropped for a time while Scottish and other matters were discussed. LT.-COL. SIR THOMAS MOORE (Ayr) talked at considerable length about Prestwick and the private company Scottish Aviation, Ltd. He said that Prestwick had become to Scotland a symbol of their sentiment and of the part which they were to be called to play in the future development of civil aviation. It was felt that Prestwick should be, in fact as well as in word, an international airport. Sir Thomas thought that all should pay a tribute to the impartiality, wisdom and sound judgment which animated the recommendations of the Clydesmuir Committee, and also to the statesmanlike judgment of the Minister in wholeheartedly accepting so many of its recommendations—but not all.

An international airport must largely depend upon adequate feeder services. On January 16th the Scottish Advisory Council announced that Scottish Aviation, Ltd., had been authorized to operate feeder services from Prestwick to Blackpool, Liverpool, Manchester, Birmingham, Leeds, Newcastle, Hull, Exeter and the Isle of Man. This sounded a lot, but the facts were that Exeter and the Isle of Man were purely seasonal work and the others were all inoperative for economic and technical reasons. Sir Thomas understood that the chief executive of B.E.A. and a representative of Scottish Aviation, Ltd., were shortly to have a meeting, with the blessing of the Minister, to see how this rather ridiculous situation could be cleared up.

MR. GRIMOND (Orkney and Shetland) said that there had been considerable dismay in Scotland over the decision to cut out for this winter—he hoped and believed only temporarily—the London-Edinburgh-Aberdeen link and the connection on to Orkney and Shetland. It was realized that there had been difficulties, but civil aviation in Scotland had suffered a setback.

MR. RALPH MORLEY (Southampton, Itchen) next spoke on the subject of flying-boats, and wished to know if it was a fact that the Solents were making a profit in the last month of their operation and that the operating costs of the Hermes were greater than the operating costs of the Solent. He also referred to Aquila Airways, who were at present using Southampton Marine Airport, and hoped that whatever influences there might be at the top level in B.O.A.C. which were discouraging flying-boats, at least Southampton Marine Airport would be kept open.

In answer to a question from Mr. Profumo, Mr. Morley said he had come to the conclusion from information received from a large variety of sources, and from remarks made by Members opposite, that there was a personage at a very high level of B.O.A.C. who was not in favour of flying-boats and that his policy was to discourage them as much as possible. He knew the name of the gentleman, but thought it would be unwise to mention it in this debate.

Mr. Morley then quoted official reports and statements concerning proposals to operate the Princess flying-boats. He concluded: "We have therefore definitely been led to believe that Princess flying-boats will, when completed, operate from Southampton Marine Airport. Now I understand they are to be used as R.A.F. transports." These flying-boats would be finished and ready to operate in 1953, he added. To what use would they be put? Would they be chartered?

The Brabazon

MR. PROFUMO took up the question of the Brabazon, summing up his remarks by saying that we were led to believe that B.O.A.C. did not relish the idea of operating it. It was up to the Government, he thought, to produce a plan by which the operation of this aircraft could be made to work.

He wished to know also whether any consideration had been given by the Government to the use of the Brabazon in war. As it would be patently uneconomic to maintain a large Transport Command in peace-time the Government should have a clear-cut plan as to how to expand this essential service, making use of the resources of the civil airlines. Would B.O.A.C. continue to operate commercially? What role would B.E.A. have, and how far had any plans gone towards making speedy conversions?

All were agreed on one thing, said Mr. Profumo, that the charter companies would be switched over immediately to military transport duties. Therefore, if only for the reason of our rearmament programme, it seemed essential that we should have a thriving group of charter concerns, which should be encouraged and fostered by the Government. These operators should be assured of a normal development of their legitimate commercial activities and should not be hampered by the Minister of Civil Aviation, as he believed they were being at the moment.

These thoughts led Mr. Profumo to reopen the discussion upon charter operations. Two solemn assurances given during the passage of the Civil Aviation Bill were that the air transport corporations would not be permitted to compete unfairly in the air charter field, and that subsidies from the taxpayers' pocket would not be used to finance or pay for charter work by the Corporations. It was patently obvious that these two promises had not been kept. We had only to look at the B.O.A.C. report of last year to see that six-million-odd capacity ton-miles were flown on charter work, which was an increase of three million over the previous year. There was a note on the report to say that this was largely due to the Berlin Airlift. But could that be so with three million capacity ton-miles? This seemed to Mr. Profumo to be a further encroachment into the charter field. It was somewhat natural that the Government should give priority to their own air Corporations when they wanted charter work done, but an analysis of the report showed that, far from making a profit, a loss was made on charter work by B.O.A.C.

G/C. WILCOCK remarked that many felt that it was quite wrong for the Corporations to do charter work, but Members opposite could not have it both ways. If they were continually pressing for a profit to be made, then the people at the head of these Corporations would go out for business.

MR. PROFUMO said that G/C. Wilcock had pointed out that although the report showed that during the period under review there was a surplus or profit on charter or "Other than Schedule Services" of £260,272, there was, in fact, no charge shown under the heading of "Operating Overheads." In the report, operating overheads were divided into "Sales Publicity, Technical Training and Development, Central Supplies and Organization and Administration." It was quite clear to anyone who really studied the report that there must have been overheads incurred in this charter flying. Elsewhere in the annual report it stated that the operating overheads of the Corporation as a whole during that period were 12.9d per capacity ton-mile. Dividing the total capacity ton-miles flown, exclusive of charter work, into the total cost of the operating overheads, the figure came to 14.4d per capacity ton-mile.

It was only by adding in the mileage flown on charter flights that one came anywhere near the figure given in paragraph 72

of the report, estimating that charter flights had no higher and no lower overhead costs than direct route flights. If one worked on that basis one got a figure of something like £32,000, which ought to be added to this report. That made it quite a different state of affairs, because instead of a financial profit of approximately £260,000, there was a loss.

Mr. Profumo said he was forced to the conclusion that the accounts had been so arranged in order to show a profit merely to safeguard the Minister's undertaking that the subsidy would not be used to finance charter work, while patently it had been used. The charter companies, of course, had no subsidies whatever and, in spite of the pressure put upon them, they had valiantly kept their heads above water and had been able to operate and make a profit. They went out of business if they did not. Why did the Government not persist with their policy of fair shares for all when it came to a question of business operating in competition against nationalized concerns? The country should not be robbed of, and could not afford to lose, these independent industries, particularly this one of air charter services.

The country required certain things from the Minister of Civil Aviation. First, it required him to abandon his parochial policy of thinking only of the interest of the Corporations; secondly, it required him to appreciate that he had a duty to the air industry as a whole; and thirdly, it required him to adopt the policy which would assist and not damage the policies put forward by the Minister of Defence.

G/C. Wilcock, after congratulating Mr. Ward on the speech which he had made in opening the debate, said that in the past criticisms might have been made with the best intentions and not have been just a party matter. Nevertheless, they had hardly encouraged those charged with the success of the Corporation. The Parliamentary Secretary in his opening speech had been quite right in saying that tremendous progress had been made in the last year or two. He [G/C. Wilcock] had noticed it in his travels, and today British aviation was really feared in a commercial sense by competitors overseas. Great strides had been made and much credit was due to those at the head of the Corporations and right down to the aircrews and the passenger handling staff. That improvement was recognized in all parts of the world.

Turning to the subject of the private operators, he said that, embarrassingly, he found himself in the same camp as Mr. Profumo. He thought the Government had made a mistake in their policy. He had consistently said that charter work should not be done by the Corporations. He was personally connected in business with charter operators, and, as was the custom of the House, declared his interest. During the Committee stage of the Civil Aviation Bill and right through the last Parliament he felt that it was unnecessary for the Corporations to enter into this field, because it would not be in the interests of the private operators, and it was definitely in the national interest that the private operators should be kept in good condition.

Civil Aviation in Wartime

Regarding the future of civil aviation in the unfortunate event of war, G/C. Wilcock said that civil aviation, including the charter companies, was the first reserve of the R.A.F. There was a reserve of aircraft and aircrews, and therefore plans should be made for it now. It was not a question of calling up reserves. We must look to the Dominions and the Colonial Governments to see that there was a plan which took into consideration the possibility of reinforcing this country. This could be done by our Corporations, the charter companies and by the Dominion and Colonial air concerns. He was doubtful whether anything would be done about this.

His criticism arose, he said, from the fact that he had been the chairman of a committee two years ago with a very distinguished list of members. This committee had made what it thought to be a very good report and had taken a year to make it. He felt that sufficient consideration had not been given by the Government to that report. There should be a standing committee to consider matters such as pre-selection of R.A.F. aircrew for civil aviation and other matters of common interest between the Air Ministry and Ministry of Civil Aviation. Very little had been done with this report or another compiled at the same time by A. Cdre. Helmore. Would the Parliamentary Secretary have these two reports dug out and would he look at the recommendations that had been made?

A. Cdre. Harvey was the next member to speak. He said that the Parliamentary Secretary seemed to be so cheerful when he made his statement that he [the Air Commodore] had fully expected him to declare an interim dividend. He seemed to ignore the fact that the Corporations had been losing more than £9 million during the year. There might be adequate reasons for part of the loss, but not for the whole amount. He asked the Parliamentary Secretary to try to do something to improve the position of Controllers in the London zone, who took greater and greater responsibility as time went on while they were grossly underpaid.

The losses of the two Corporations combined were £9.2 million as against £9.7 million for the previous year. That was not a very big reduction considering the new types of aircraft that had been brought into use. He realized that costs had increased, and was sympathetic to the fact that the Corporations had to accept a lower rate for the carriage of mail than had foreign airlines. The maximum rate was six gold francs per ton-kilometre. That was the rate allowed in the Postal Convention. But B.O.A.C. and B.E.A. had had nothing like that. The Americans got considerably higher rates. Had the Parliamentary Secretary put up a case for the proper rate to be paid for the carriage of these mails?

B.E.A. certainly had the plum routes of the world, said the Air Commodore. If they could not pay on the routes to Paris and other parts of the Continent, the Channel Islands and Scandinavia, they never would.

Flying Boats—B.O.A.C. Policy

It seemed to him that B.O.A.C. had not a clear policy. Confining his remarks to the Princess flying-boats he referred to the official report of March, 1951, regarding the rapid progress with the Comet and the belief that this aircraft would be better adapted to the needs of civil aviation than the larger flying-boats. Surely the Corporations and the Minister knew a year ago how good the Comet was? It had been flying for two years and had done something like 500 hours. Why had this matter been left for two years? He was not at all satisfied with the explanation, which went much deeper than that. He knew what one heard in aviation gossip: that B.O.A.C. had had their doubts all along about the operation of flying-boats. He did not want to go into this matter except to say that B.S.A.A. gave an undertaking, through A. Cdre. Brackley, that the boats would be operated by the Corporation. B.O.A.C. were fully committed, and took them over under the Air Corporations Act on July 30th, 1949. B.O.A.C., if they had had any doubts about the flying-boats, should have had the matter out with the Minister of Civil Aviation at that time. When they were asked to take over the commitments of B.S.A.A. they should have made it clear that they had no intention of operating these boats unless they were given certain financial facilities. He suspected that they were not big enough to do that, and that they were instructed by the Minister of Civil Aviation and the Minister of Supply that these boats were a commitment and had to be operated. Pressure must have been brought to bear from both Ministries.

On July 23rd, 1950, when a delegation of Members of Parliament went down to the flying-boat base at Hythe, the chairman of B.O.A.C. had said:

> "B.O.A.C. is flying-boat-minded. I believe that Britain has a definite lead in flying-boat manufacture and operation. We want to see the passenger attraction of this type of aircraft upheld."

On October 13th, 1950, only five months ago, B.O.A.C. gave a hand-out to the Press. Headed "Formation of B.O.A.C. 'Princess' Unit. Preparing the way for Britain's great new flying-boat," it said: "A B.O.A.C. 'Princess' unit is being formed to prepare for the introduction into the service by the Corporation of the 105-seater Princess flying-boat at present being built at the Saunders-Roe Works at Cowes, Isle of Wight."

It had gone on to speak about the management in charge and so on. It was a most extraordinary thing to make these public statements one after the other if there was a disagreement or lack of confidence in the Corporation. Why had the House and the public been misled on this important matter which involved several million pounds?

After further discussion, A. Cdre. Harvey turned to the question of subsidiary companies. He felt that if B.O.A.C. confined their efforts to operating world trunk routes instead of having investments in so many other companies everybody would be better off. The loss in that direction, after deducting what few profits there were, was £287,400. [The greatest loss—£218,425—was made by British West Indian Airways.] A. Cdre. Harvey congratulated International Aeradio, Ltd., which had made a small profit. He believed that it rendered a great service to civil aviation.

Of the companies associated with B.O.A.C., Aer Lingus showed a reduced loss. If ever this country struck a bad agreement it was with Aer Lingus, for the route between London and Dublin should have been a gold-mine. According to the report, Hong Kong Airways was sold out, but how much money had it cost the Government? Enormous sums had been spent out there. The people on the spot should have been left to operate with their own money. The same applied to the subsidiary companies of B.E.A.

Mr. Geoffrey Cooper was the next to add his criticisms. The first concept of International Aeradio, Ltd., was a good one, but what had happened was that we were really running I.A.L. largely for the benefit of other countries whose contributions in terms of the shares they had taken up was not proportional to the

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services rendered to them. He believed I.A.L. could have become a truly international company.

He went on to list as "disappointments" certain aspects of the development of London Airport, the Brabazon, the handing-over of the Princess flying-boats to Transport Command, and the de Havilland Comet. Of the last-named he said he was not quite so optimistic as another member who suggested that it was the sort of great white hope of our civil aviation. He thought that the Comet had been grabbed at by B.O.A.C. as a drowning man grasps a straw. He was not yet convinced that a jet aircraft could be operated sufficiently economically over sufficiently long stages to ensure the operating company making a profit from its operation.

Mr. Cooper next referred to the improvements that had been made in the Corporations' operations in the last few years. It had been said that since 1938 the British Corporations had increased their passenger mileage 11 times, which sounded a formidable increase in their activities, but as an indication that other countries were forging ahead more rapidly it was worth noting the results which were being achieved in some of those other countries. Norway, for example—starting, perhaps, from a point lower down the scale than we were at in 1938—had increased its total 56 times in a similar period, Canada 41 times, Ireland 34, India 25, Australia 19, the U.S.A. 16, South Africa 15, France 13 and New Zealand 12. Then came the United Kingdom, tenth down the list, with 11 times. Belgium, Denmark and Switzerland had each increased 10 times.

Mr. Cooper then referred to the reports of the two Corporations, to their policies and management. He contrasted B.E.A. and B.O.A.C., to the advantage of the former. There were two ways, he said, in which public corporations could operate; the first was by the policy-board of governors, rather similar to that of B.O.A.C. Under that there was the chief executive with his board of administrative and technical officers. He believed that in the case of B.O.A.C., and certainly some of the other Corporations, far too much was referred to the centre, which prevented immediate decisions and imaginative work from being done by those lower down in the organization. These boards had tended in the past to be made up of what might be termed "safe" men, who were not likely to cause too much trouble to the officials in the M.C.A. Sometimes they were ex-Civil Service or ex-R.A.F. men who were rather too old to grasp the new problems of a technical and commercial nature thrown up by civil aviation.

Corporation Efficiency

Lord Malcolm Douglas-Hamilton took up the point of running the Corporations as efficiently as possible and the necessity of cutting out dead wood. He had, he said, some rather interesting comparisons to quote. The American airlines considered that an annual utilization of their aircraft of about 3,000 hours was necessary. He found that in B.E.A. the annual utilization was only 1,320 hours. That was one element that could quite clearly be improved. Looking at the figures of staff—in comparison with those of Trans-Canada Air Lines, for example—B.E.A., flying rather less than twice the mileage of T.C.A. (who fly 16,364,000 miles to B.E.A.'s 30 million miles), had rather more than four times the staff of T.C.A.

Lord Malcolm Douglas-Hamilton recalled that before the war he had not much liked the monopoly which Imperial Airways had represented—it had showed a reluctance to advance for one reason or another. But in those days it was still possible to run an airline without incurring the penalty of a £5,000 fine or two years in prison. Now we had a monopoly which was firmer than ever.

Spokesmen of the Government said that they wanted to encourage and even to help our charter services, but in reality the Minister seemed to be more intent on making the Corporations unassailable and to be helping them virtually to wreck their potential rivals.

In January, 1949, the Minister issued a directive which did a lot to torpedo the future of independent operators. There were about six provisions in this directive which really were wrecking provisions. These he quoted, and in answer to a question from Mr. Beswick mentioned one particular example: that fares should not be less than those charged by the Corporations. Mr. Beswick said that before that directive was issued it was not possible for the private operators to engage in scheduled operations at all.

Continuing, Lord Douglas-Hamilton said that the Minister had indicated that he was a watchdog for the taxpayer. He [Lord Douglas-Hamilton] would quote an example of what happened when the Nigerian Government wanted a service between this country and the colony. A charter company had been approached which had suitable aircraft to run a service. There was no expense involved to the taxpayer on either side. However, this was not allowed, and one of the Corporations (he thought it was B.O.A.C.) put on aircraft obviously unsuitable. It had been alleged that each flight had cost the taxpayer £10,000.

Lord Douglas-Hamilton said he would like to know if B.E.A. and B.O.A.C. were serious about not wanting to enter the charter trade. They had representatives now at the Baltic Exchange and, through that exchange, the independent charter companies had built up a considerable business. In another place Lord Douglas of Kirtleside had indicated that these agents were there only to obtain freights for the Corporations. He should not like to contradict him, but if he examined the amount of business that these agents had got for the Corporations, he might have given a different answer. Above all, the Corporations must not be considered sacrosanct. They must not be protected from competition.

Returning to the subject of Prestwick, Lord Douglas-Hamilton first corrected earlier speakers by saying that this was never a small private flying club. From the beginning it was an airfield which was training aircrew for the R.A.F. The question of handing it back to private enterprise never arose, because at the end of the war the then owners of Prestwick offered it to a public corporation in Scotland. The impression the Government had given was that they just decided that they would take over Prestwick. They had not done that even yet, but they had merely decided to take it over—with scant recognition of the pioneer services rendered there.

On the subject of developing aviation in Scotland, he said that what was needed was the provision of airlines to areas on the west coast. There were still quite a lot of people who could virtually only be reached by one of three methods: by helicopter, by flying-boat or by means of the tremendous cost of making new airstrips. The obvious way would be to develop flying-boat services. Ullapool to Skye; Tobermory to Oban; and along the Caledonian Canal were services suggested. Furthermore a little imagination could be used to develop an air mail service on the west coast in which helicopters would be very useful.

After a few words championing the cause of private pilots and private flying, the discussion once more turned to charter flying, and then to the possibilities of Fido.

Mr. Geoffrey Lloyd contributed a comprehensive description of the development and potentialities of this aid. Some 2,500 R.A.F. aircraft had landed with the help of Fido during the war. Mr. Lloyd said that it was easy to build up a great case against Fido for civil use on the grounds of extravagance, and Lord Nathan had taken the figure up to £3,650 an hour. In order to correct the high estimates which had come from Government spokesmen in the past, he quoted an estimate from a scientist engaged in developing this apparatus during the war. He admitted that this went rather to the other extreme. Taking two minutes for landing on a 1,500-yard runway and using one-third of a gallon per minute, then in conditions in which there was no wind or a parallel wind and we had had two lines burning, it would cost £100, whereas for a cross-wind and only one line it would cost £50. Cross-wind conditions occurred three times more frequently than the conditions of no wind or a parallel wind, which demanded two burners, so that the average cost of the operation, on these calculations, would be £62 10s for landing an aircraft. He did not know whether that would be considered as too high a figure for saving lives and perhaps for saving an aircraft like the Comet, which was worth £500,000. The cost ought to be spread over the whole of the aircraft using the landings, much as Trinity House dues were spread over the whole of shipping. We might then be able to reduce the cost to 10s or 15s per aircraft landing.

From the many other speeches which were made before the debate ended, the following highlights emerged. Mr. Pargiter was in favour of the most rapid development possible of the Comet, because it seemed that this was our one aircraft which was so far ahead of competitors that it gave a real fighting chance to get on top of the world so far as civil aviation was concerned.

Mr. W. T. Aitken referred to passenger comfort. Safety and price were important factors affecting airlines, but comfort, particularly on the ground, he would put very high on the list. He gave specific instances which he had experienced on a recent flight to Africa.

S. L. Kinghorn said that he had a feeling about air travel that it was all first class, and there was no second or third class. He would like to see a more democratic use of our airlines . . . to make our people—adults or young people in the industrial areas—air-minded. He mentioned the London Passenger Transport Flying Club and said that in view of rearmament and the sums of money which had to be spent, one of the best ways to use a small portion of the total would be to help in the revival of the democratic flying clubs so that ordinary working men and women throughout the country could learn to fly.

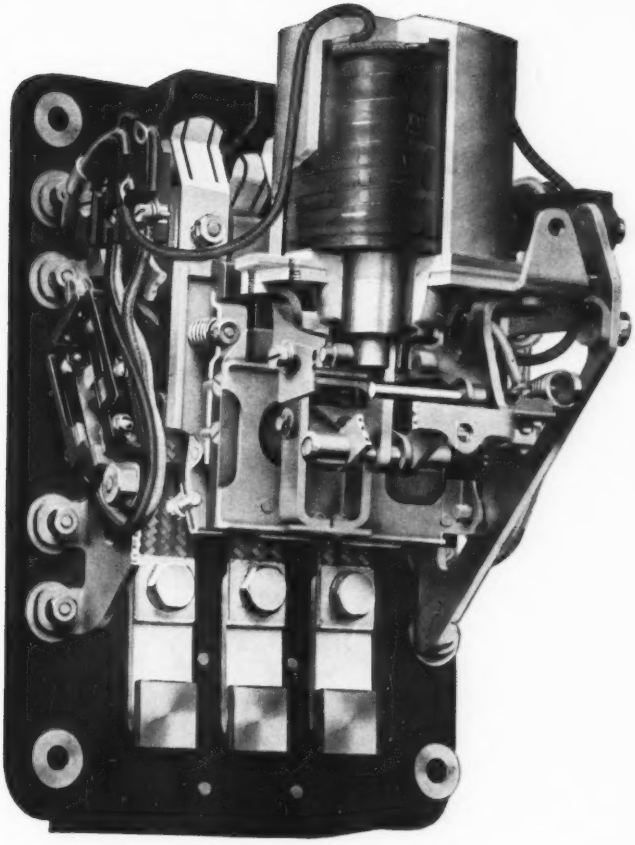
Sir William Darling referred to rates for the carriage of mail and to high landing fees. On internal operations B.E.A. paid landing fees of 8.66 per cent of revenue compared with 2.96 per cent on Continental operations. He referred to one "remarkable" reason given for Corporation unprofitability—the levy of a heavy petrol tax. It was within the knowledge of the House that other industries had to pay a heavy petrol tax, yet this great organization, he said, put forward that it had to pay the same tax as others as a reason for not being successful.

Mr. Rankin quoted figures in talking about what had been done for aircraft services in Scotland as a whole. During the period between 1945 and 1950, £1,428,000 had been spent on the maintenance and development of aerodromes. A sum of £1,050,000 had been spent on navigational services. On research, £375,000 had been spent in establishing the "G" chain which it was hoped would lead to a reduction in aircraft accidents. In the five years since 1945, £2,560,000 had been spent in construction, navigational and research services in Scotland. Some return was now evident, because increasing air-consciousness was shown in Scotland today. In 1938, 27,000 passengers used the civil aviation services. In 1947 the number was 107,320, and last year it had risen to 145,200. That was a significant and welcome development.

Mr. Beswick's reply and answers to questions at the end of the debate included the statement (to Sir William Darling) that by far the greatest single item in the Corporations' accounts—of the order of £462,000—resulted from the services provided in Scotland. He pointed out that the whole 36 conversions of B.E.A. Dakotas had been given to Scottish Aviation at Prestwick. Regarding services to the Western Isles, it was unlikely that a service could be given until a multi-engined helicopter became available for service three to five years from now.

On the subject of Solents and Hermes he could state that during the last four months of the Solents' operations, the six Solent flying-boats carried 3,900 passengers, while in a similar time the four Hermes had carried 4,317 passengers and proved so successful, bookings being so heavy, that the service to Nairobi was having to be increased.

In connection with Fido, Mr. Beswick emphasized most strongly that there had been no question of reducing the margin of safety or any reluctance to install Fido apparatus at some airports. If weather was too bad, the policy was either to cancel a flight or divert to fog-free airports. Safety was ensured by this policy. If an aircraft set out for this country and in the course of flying the weather blotted out all the available airports, it was possible to resort to one airport at least with Fido. If Fido had been installed at either London Airport or Northolt, it would not have secured additional safety. It would have bought additional regularity and additional punctuality. What price could be paid for these two essential factors? It was a commercial consideration, not a matter of safety. With the cost of landing one aircraft varying from £625 to £1,500, this system was clearly prohibitive.



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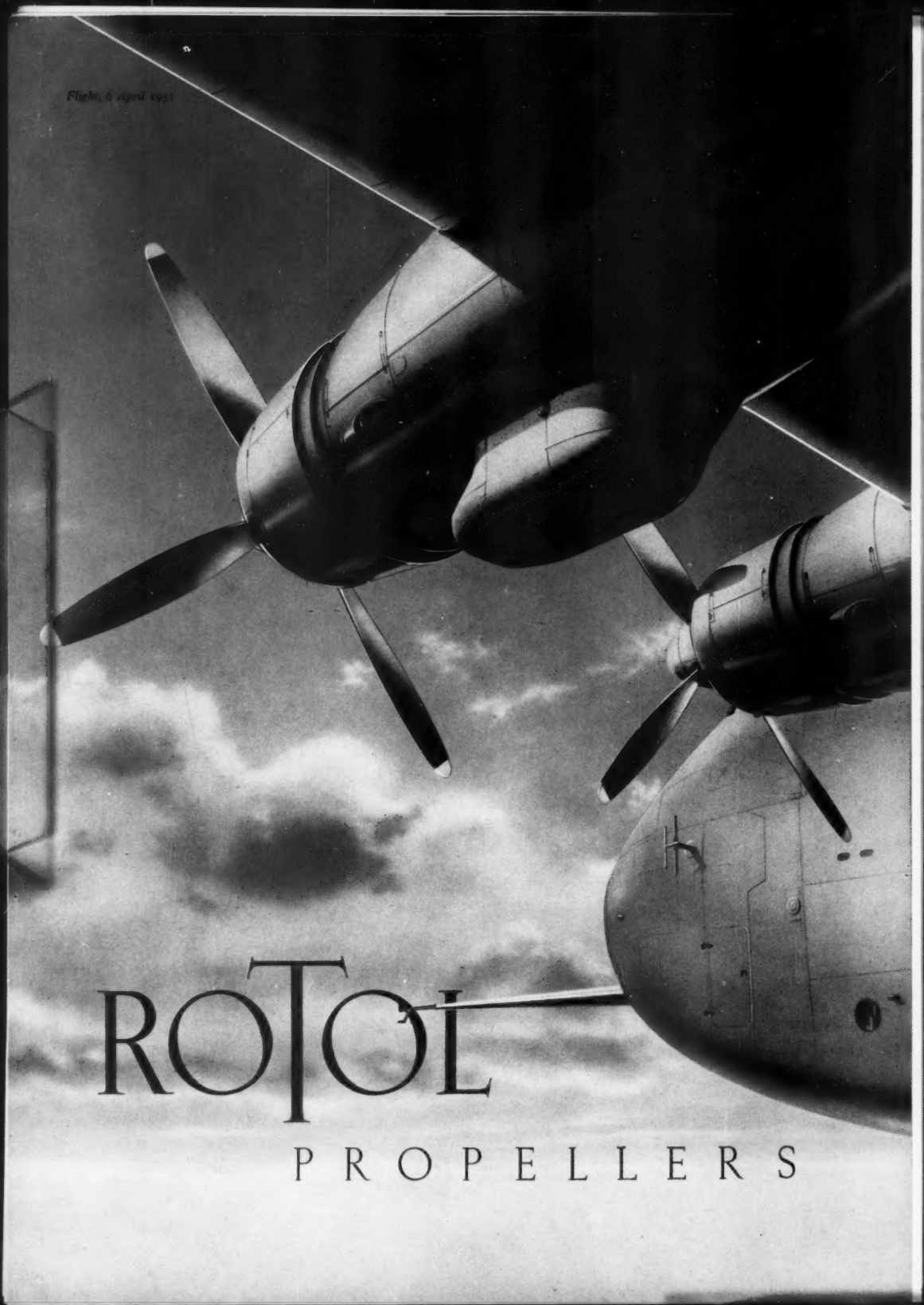
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CIVIL AVIATION . . .

T.W.A. BOARD MEETS IN LONDON

AN unusual event occurred in London on March 30th, when an American airline company, Trans World Airlines, held a board meeting there, in pursuance of its new policy of arranging such meetings in various capitals to which it operates. This was the first time the board had met outside the United States.

The meeting was followed by a reception and banquet at the Savoy Hotel, at which the guest of honour was the Lord Mayor of London, Alderman Denys Lowson. Mr. Warren Lee Pierson, T.W.A.'s chairman, presided. Other guests included Sir Miles Thomas and Sir Alexander Maxwell, chairman of the British Holidays and Travel Association, and Mr. Gerald Barry, Director-General of the Festival of Britain.

A point of particular interest that emerged from the after-dinner speeches was Mr. Pierson's admission that T.W.A. is very interested in the Comet. During the week 11 members of the board had been carried on demonstration flights from Hatfield and technical representatives have already made a detailed examination into the possibilities of Comet operation by T.W.A. The company's directors are said to have been "very impressed" by the Comet's fast and effortless climb to 36,000ft.

It was disclosed during the meeting that greater capacity, improved equipment and increased efficiency enabled the company to earn a consolidated net profit of $6,495,000 last year after paying taxes of $3,467,000. Operating revenue reached the unprecedented total of more than $117,000,000, an increase of $11,500,000 over the figures for the previous year. A rise of 19.3 per cent in passenger-miles flown accounted for a revenue increase of over $10,000,000, while revenues from cargo-traffic rose by almost $1,000,000. Operating expenditure increased by only 6.7 per cent over the figure for the previous year.

A notable feature of T.W.A.'s results is the fact that, although the total of revenue aircraft-miles flown actually fell by 4.8 per cent, the ton-mileage figure rose by 17.4 per cent, an indication of the greater earning capacity provided by the company's aircraft during the year.

SIGNS OF THE TIMES

ACCORDING to newly published I.C.A.O. statistics, the passenger-mileage recorded by the world's civil airlines last year was more than 18 times the figure for 1937. The actual total was 16,404,000,000, as compared with 885,000,000 in 1937. The total of passengers carried was seven times as great and the total of aircraft-miles flown five times as great during the same period.

Another interesting point is that the average number of passengers carried per aircraft is now 3½ times that of 13 years ago and 12 per cent greater than the figure for 1947. These totals, however, exclude all traffic carried on Russian airlines, of which details have not been disclosed.

AERIAL WORK IN NEW ZEALAND

THE spectacular development of air transport in New Zealand last year was recently reviewed by the Minister of Civil Aviation, the Hon. T. L. Macdonald, who announced that the Cook Strait rail-air service was expected to bring the total of freight lifted during the current financial year to more than 30,000,000 lb. He pointed out that, although there had been important developments in passenger and freight services, progress in other directions had been even more noticeable. Since April 1st, 1950, a mere handful of companies, using eight or ten light aircraft for aerial top-dressing work, had become an industry of 26 firms, employing more than 70 aircraft. Even more remarkable developments, said the Minister, were shortly expected.

Some of the actual results achieved included a total of 8,957 hours flown during the period from April 1st to December 31st, in which nearly 56,000,000 lb of fertilizer and soil-dressing were dropped. The areas treated totalled 250,000 acres. Seed-sowing and rabbit-poisoning, entailing the dropping of a further 500,000 lb of material, was carried out over some 117,000 acres.

BANANA JUNIOR: This twin-rotor light helicopter, which recently made its first flight in the United States, is claimed by its manufacturers, the McCulloch Motor Company, to have a rate of climb exceeding 1,500ft/min. Intended primarily as a two-seater for rescue and agricultural duties, it is seen to bear a certain resemblance to the larger Piasecki.

ATLANTIC "TOURIST" FARES?

A PROMINENT American senator recently introduced a resolution in the U.S. Senate, calling upon the Maritime Administration and the C.A.B. to "explore every available means" of providing additional transatlantic passenger services at lower cost. The resolution notes that lack of adequate facilities during the summer season at rates within the reach of the middle-income public is at present limiting the extent of such travel. Its object is to determine ways in which maximum utilization can be made of existing services by introducing low-fare arrangements, charters and group contracts. If such methods are found to be practicable on this route it is expected that legislation will be sought.

A NEW NAVAID

AT an annual meeting of the Institute of Aeronautical Sciences, which took place recently in New York, details were given of a new radio-navigation system which can be applied to the control of dense air-traffic within airport terminal areas. Trials with the device, which is essentially an omni-bearing-distance system based on the Sperry 5,000 mc/s "Rho-Theta" system, are now being carried out under the Air Navigation Development Board's evaluation programme by the U.S. Air Force All-weather-flying Division at the Wright-Patterson base.

A new kind of distance-measuring, based on the phase-measurement principle, forms an integral part of the 5,000 mc/s omni-range. In addition to the usual omni- and distance-indicators, cockpit presentation includes a graphic computer display, which plots the aircraft's position and track on a map representing the terminal area.

BREVITIES

THE M.C.A. is to reduce its grant to B.O.A.C. for next year from £6,070,000 to £5,000,000; the sum for B.E.A. will be £700,000 as compared with £1,500,000 for the current year.

* * *

In addition to the two DC-6Bs which, as mentioned in *Flight* last week, S.A.S. have had on order since last year, an order for five further aircraft of this type has now been announced. When delivery is completed in 1952 the size of the S.A.S. fleet of DC-6 type transports will be increased to 20. All the future deliveries will be of the 52-passenger versions arranged for optional sleeping accommodation in the after-cabin. The total of DC-6Bs which Douglas now have on order is 83.

* * *

Passenger and freight traffic in February on B.O.A.C.'s Stratocruiser services between New York and the Bahamas was the greatest ever recorded; the total of passengers carried during the month was 1,785. Since its inauguration last November an increasing number of American tourists has been attracted to this route, on which the Corporation operates five flights weekly.

* * *

P.A.W.A. is to increase the frequency of its New York-Paris Stratocruiser flights from three times weekly to a daily schedule; the change is effective from May 1st. In addition the weekly Constellation flight from New York to Nice will, from the same date, be extended to Rome. Pan-American will then serve Rome

CIVIL AVIATION NEWS . . .

four times weekly via Paris and once by the southern route. These increased frequencies are the result of a new agreement between the United States and the French Government.

* * *

Mr. R. W. Ryan, previously manager of the Canadian company Prairie Airways, a forerunner of Canadian Pacific Airlines, has now been appointed vice-president of the latter company.

* * *

International and inter-island air services operated by Philippine Airlines in 1950 resulted in a profit of approximately $355,000. The company has experienced rapid expansion since resuming services in February 1946; in this period, its route network has grown from 485 to over 25,000 miles. Revenue passenger-mileage and cargo ton-mileage flown last year represented increases of 27 and 65 per cent respectively over figures for the previous year.

* * *

With effect from April 15th, passenger fares on B.E.A.'s internal services between Glasgow and the Scottish Highlands and between Wick and Aberdeen and Orkney are to be increased. From the same date, also, the cost of monthly return tickets between London and Belfast and between Glasgow and Belfast will be subject to slight increases, while from June 1st fares between Penzance and the Scilly Isles will be similarly affected.

* * *

To meet peak holiday-requirements for travel between the Channel Islands and London, two of the main charter companies at Croydon, Olley Air Service, Ltd., and Morton Air Services, Ltd., have been granted permission to operate six return services between Croydon and Jersey and five return services between Croydon and Guernsey on each Saturday during the period June 30th-September 1st. These arrangements are being made under associate agreements with B.E.A. Single fare to either place is to be £5 5s, and return fare £9 10s.

* * *

The Oakland (California) Board of Port Commissioners is to file a petition with the C.A.B. in Washington for reconsideration of the latter's decision in the Southern Trans-continental Route case. Ignoring the recommendation of its own examiner, the C.A.B. recently granted authority to American, Delta, National, Braniff and other airlines to engage in a complicated inter-change arrangement along the route serving the south-west, south and south-east regions of the United States. The Oakland authorities are supporting the application of Eastern Airlines for a one-carrier service along the route.

* * *

On March 27th the Chief Justice of Hong Kong opened the Supreme Court hearing of the application by Civil Air Transport Incorporated (owned by the American partnership of General Claire Chennault and Mr. Whiting Willauer), for the return of 40 aircraft and other assets which were formerly the property of the Central Air Transport Corporation of China.

* * *

Operating a fleet of two Dakotas, Panama's only airline, C.O.P.A. (an affiliate of P.A.W.A.) carried a total of 12,172 passengers last year. This company—probably the smallest operator in the world to claim the status of an airline—operates regular daily services between Panama City and David, some 300 miles inland.

* * *

A loss of £6,000 during the last year in the provision of catering facilities at London Airport has forced B.O.A.C. to abandon the contract. The M.C.A. is now understood to be inviting tenders from private contractors. Under the terms of the contract B.O.A.C. have in the past had to pay a 15 per cent share of the gross takings to the M.C.A. B.E.A. fared more favourably with their catering account last year and the small profit made is now helping to defray the cost of extending the existing restaurant at Northolt.

* * *

For the first time since 1946 a Russian delegation attended a session of an I.C.A.O. conference, which took place in Montreal on March 27th. Russia declined to join I.C.A.O. in 1944, because she considered that Spain, Portugal and Ireland were not acceptable as member nations. It is thought unlikely that the U.S.S.R. has changed her attitude towards I.C.A.O., and that representation at this particular session is merely due to her interest in certain of the problems under discussion. All countries have standing invitations to attend open meetings.

* * *

By an inter-line agreement between Central African Airways, B.O.A.C. and South African Airways, considerable reductions have been introduced in the fares for families flying between Salisbury and London via Nairobi or Livingstone. The normal return fare is £275 8s, but a reduction of £100 is made for a wife travelling with her husband; there are even greater rebates for children. A man travelling with his wife and two "teen-age" children would thus save about £300. Similar concessions apply from other points in Central Africa.

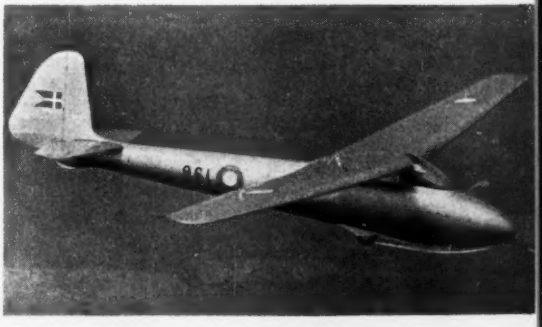
FROM THE CLUBS

THE Ultra-Light Aircraft Association held its annual general meeting—followed by an assembly of its general council—at Londonderry House last Saturday. One of the most important items on the agenda was the presentation to the first winners—the Cardiff Ultra Light Aeroplane Club—of the Masefield Trophy. Donated by Mr. Peter Masefield (chief executive of B.E.A.), who is himself a keen ultra-light aircraft enthusiast, the award is to be competed for annually between the Association's affiliated groups.

NEWS from India tells of the exceptional success of this year's national air rally, which took place recently at Chakeri, Kanpur, United Provinces. Organized by the chairman of the Council of the Aero Club of India, Mr. Biren Roy, it was the second event of its kind to be held in that country. The three-day programme included three races—the first, a long-distance contest over a direct route of approximately 1,124 miles, the second a circuit over two laps of 84 miles each, and the third—believed to be unique in rallies of this kind—a race at night over a triangular course of 269 miles.

The long-distance race, for the Jawaharlal Challenge Trophy and approximately £400 cash, was won by Mr. Y. Bhandarkar, flying a Stinson L-5. The holders of second and third places received trophies and cash prizes of £180 and £100 respectively. An Indian woman pilot, K'rani Kusum Singh, who completed the course solo in a Chipmunk and arrived even before an experienced Belgian pilot flying a twin-engined Aero 45, was awarded the Caltex Challenge Trophy and a prize of £100.

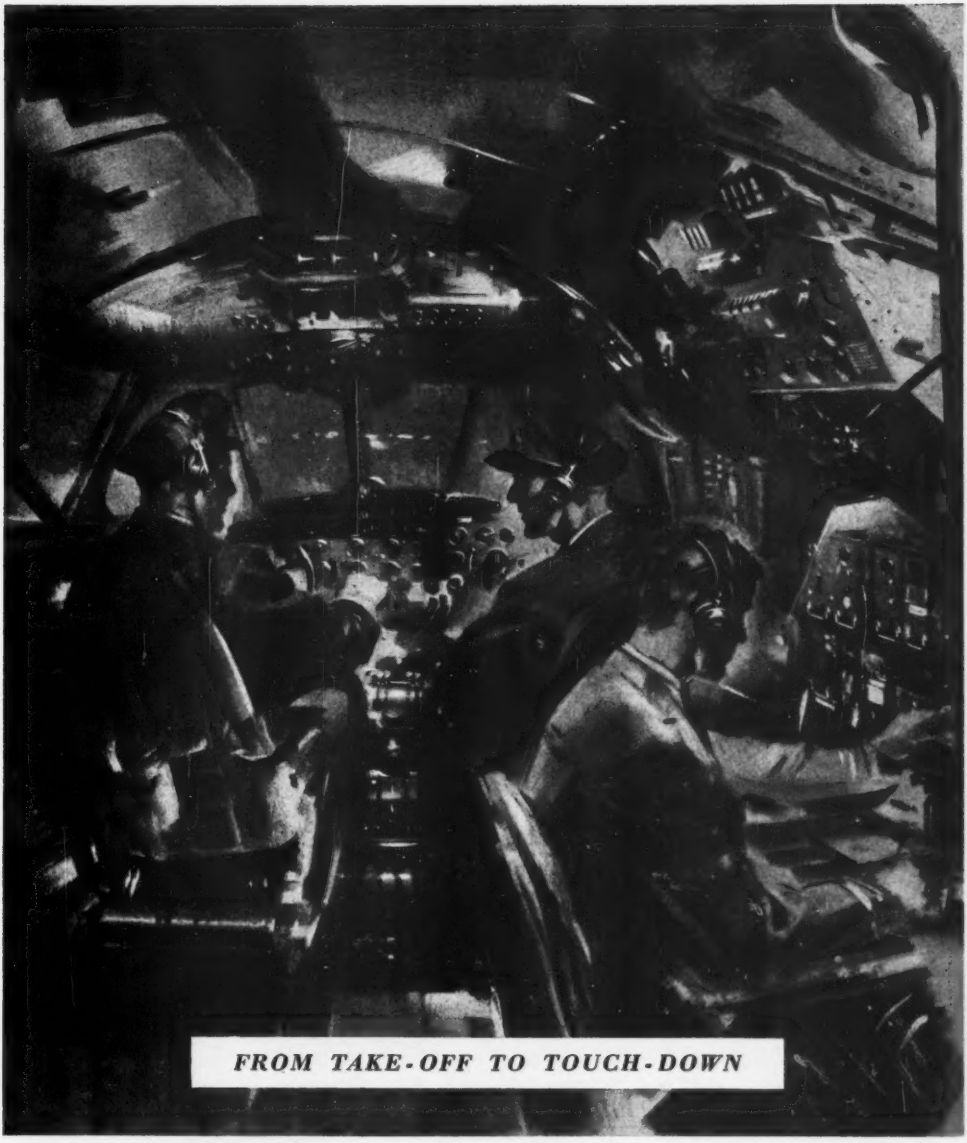
The circuit race was won by an amateur pilot, T. P. Singh, who had to compete with a strong field, which included a large number of professional pilots. Capt. M. V. Namjoshi was second in an Expeditor. The latter pilot also won the night race, flying the same aircraft. It may be recalled that last year Capt. Namjoshi, who is very well known in Indian aviation circles, won the National Air Race in a Piper Cub. He also won this year's open aerobatics event, competing against several foreign pilots, who included Fraulein Liesel Bach of Germany.



THE EON OLYMPIA, whose ancestry—the subject of a question in Parliament—is discussed on page 392. A great many have been exported: this example, with Swedish markings, was delivered by air last year.

A special prize was also given to S/L. Ranald Porteous, now on a demonstration tour of India, for his display of crazy flying with an Auster Aiglet. This was a demonstration that aroused particular enthusiams among the spectators.

The rally was opened by Pandit Jawaharlal Nehru, Prime Minister of India, on February 17th and the distribution of prizes was made on the afternoon of the 20th by the President of the Republic, Dr. Rajendra Prasad. Before the conclusion of the meeting, also, the Indian Air Force contributed to the programme with displays of formation aerobatics, using Vampires and Spitfires. During the course of the flying display parachute jumps were made by Indian Air Force personnel and the first Indian-built glider was also demonstrated.



From the day in 1906 when the first experiments were made in air-to-ground radio, Marconi's have led the world in the important field of air-communications. To future generations the results of the experimental work on which Marconi's are now engaged will be just as far-reaching.

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MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · MARCONI HOUSE · CHELMSFORD ESSEX

On March 21st, 1951, at the Central Fighter Establishment, R.A.F. West Raynham, a Naval Aviation Pilot saved his life by using the

Martin - Baker Patent Ejection Seat

in a jet aircraft which was in difficulty.

Martin-Baker Aircraft Company Limited
Higher Denham, Nr. Uxbridge
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SERVICE AVIATION

Royal Air Force and Naval Aviation News

THE Air Minister, Mr. Arthur Henderson, arrived at Gutersloh on March 28th for a six-day visit to units of the R.A.F. in Germany and Austria. On April 2nd he attended a combined R.A.F.-U.S.A.F. demonstration of fire-power at Fassberg, in the British Zone. The display included the first European exhibition of the use of napalm bombs, which were dropped by Thunderjets.

No. 25 Group Re-formed

TO meet the increasing demand for aircrew, Flying Training Command is being expanded, and a war-time group, No. 25, which was disbanded in 1948, has been re-formed. Its A.O.C.-in-C. is A.V-M. R. B. Jordan, C.B., D.F.C., A.D.C., who was until recently Commandant of the Royal Observer Corps.

Small-arms competition

RESULTS of the R.A.F. Small Arms Association championship shoots, held at Uxbridge on Saturday, March 31st, were as follows:—

Individual Small-bore Rifle Championship.—1, S/L. K. Alder (R.A.F., Uxbridge), 200 ex 200; 2, F/L. K. H. Wallis (Scampton), 199; 3, G/C. G. E. Watt (H.Q. Fighter Command), 199.

R.A.F. Pistol Championship.—1, W/O. R. Sperring (Kirkham), 179 ex 200; 2, W/C. R. F. B. Guy (H.Q. Flying Training Command), 178; 3, F/O. Williams (Waddington), 177.

W.R.A.F. Pistol Team Championships.—1, Leconfield, 208; 2, Uxbridge, 205.

W.R.A.F. Rifle Team Championships.—1, Leconfield, 777; 2, Sealand, 755.

R.A.F. Inter-station Pistol Team Championship for the "V.J." Trophy.—1, H.Q. Flying Training Command Unit, 673; 2, R.A.F. West Kirby, 648.

R.A.F. Inter-station Rifle Team for Nobel Cup. — 1, Leconfield, 1,171; 2, Hemswell, 1,167. (In the semi-finals of this contest R.A.F. Hemswell's shoot against Bridgnorth resulted in a dead heat, score 1,188, and the tie had to be re-shot at Uxbridge.)

Indian Anniversary

CEREMONIES were held on April 1st. at all bases of the Indian Air Force to mark its 18th birthday. The Indian President and Prime Minister witnessed a fly-past and display at New Delhi, at which Air Marshal Sir Ronald Ivelaw-Chapman, the A.O.C.-in-C., pledged the "wholehearted and unswerving allegiance" to India of all ranks of the Service.

R.A.A.F. Follow R.A.F.

THE Transport Command practice of employing rearward-facing seats in its newest passenger aircraft—Hastings and Valettas—is being followed by the Royal Australian Air Force. Declared R.A.A.F. policy is to install tail-facing seats whenever possible in the future; some Lincoln transports have already been so equipped.

Inter-Services Boxing

AN R.A.F. station—Hullavington—has been selected as the venue for this year's Imperial Service Boxing Association Championships. Preliminary bouts will be on April 10th; the finals take place the following day.

Mid-Atlantic Ambulance

DURING the search for survivors of the American Globemaster lost on Good Friday, the torpedo officer of the submarine *Thule*, Lt. F. D. Willis, was taken ill with suspected mastoiditis in mid-Atlantic. The Admiralty, informed of the situation by wireless, advised penicillin treatment and arranged for his transfer to the American carrier *Coral Sea*. The carrier sent a helicopter to the submarine, and Lt. Willis was helped into a stretcher hanging from the helicopter as it hovered overhead. A few minutes later he was being tended by a doctor in the *Coral Sea*.

F.E.A.F. Liaison

NOW responsible for liaison between the H.Q.s of the two Far East Air Forces (British and American) is S/L. M. C. Adderley, D.F.C., who has been transferred from Singapore for a tour of exchange duty with the U.S.A.F. in Korea. He replaces S/L. J. F. Sach, D.S.O., D.F.C., who has been attached to the U.S.A.F. for nearly a year. S/L. Adderley will serve under the American F.E.A.F. Directorate of Operations, spending the first six months in Korea and completing his exchange duty in Tokyo.

A.V-M. R. G. HART, C.B., C.B.E., M.C., A.R.C.S., recently appointed Director-General of Technical Services (II), Air Ministry.

FIGHTER TYPES: Two British Commonwealth pilots in Korea. In the cockpit of his Mustang is F/L. Ian Olorenshaw, D.F.C., of No. 77 Squadron, R.A.A.F.; he was one of the first Australian pilots to fly over 100 sorties in Korea. Wearing American flying-kit, F/L. Stephen Daniel, D.S.O., D.F.C., (right) is a Scot serving with the 4th Fighter-Intercepter Wing, U.S.A.F., under the exchange scheme. He flies an F-86 Sabre.

R.A.A.F. Canberras

RECENT newspaper reports that an English Electric Canberra would attempt a record flight to Australia have been officially denied by the Australian Minister for Air, Mr. T. W. White. He explained that, pending production of Canberras by the Government aircraft factory at Melbourne, the R.A.A.F. was buying two aircraft from Britain. The first would be flown to Australia by W/C. D. R. Cuming, A.F.C., and F/L. C. G. Harvey. There was no definite intention of breaking records in the course of this normal ferrying operation.

R.C.A.F. Ambulance Service

PREPARATIONS have been made by the R.C.A.F. for flying Canadian soldiers wounded in Korea from McChord Field, Washington, to hospitals in Canada. Evacuation from Japan will be carried out by aircraft of the Pacific airlift to Korea, including the Canadair North Stars of No. 426 Squadron, which are operating under the U.S. Military Air Transport Service. From McChord, the casualties will be carried by Dakotas of No. 435 Squadron, which have been equipped with stretchers and oxygen equipment. Each Dakota will carry 14 patients, a nursing sister and a flight medical assistant. Casualties not requiring attention *en route* will fly to Vancouver by C.P.A.

R.A.F. Appointments

TAKING the acting rank of Air Commodore, G/C. W. S. Hebden has been appointed Director of Flying Training at the Air Ministry. Until recently he served for a year at the Ministry in the Directorate of Personal Services. Aged 42, A. Cdre. Hebden joined the R.A.F. as a cadet in 1927 and was commissioned from Cranwell in 1929.

An exchange of appointments is announced for two senior officers of the R.A.F. Regiment—A. Cdre. E. W. Towsey, O.B.E., and A. Cdre. C. J. Luce, D.S.O. A. Cdre. Towsey thus becomes Command Defence Officer and Senior R.A.F. Regiment Officer at H.Q., Middle East Air Force, and A. Cdre. Luce takes up a similar appointment in Germany with B.A.F.O. Both officers were originally in the regular Army and received permanent R.A.F. Regiment commissions in 1948.

Reunion

NO. 83 Group (R.A.F.) Officers' Association.—All-ranks reunion in London on Friday, April 7th. Tickets (5s exclusive) and further details from F. B. Berry, 11, Bush Hill Road, London, N.21.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Airspeed History

THANK you for publishing my previous letter in the March 16th issue of *Flight*, together with the comments upon it provided by Airspeed, Ltd.

The remarks made about the Airspeed AS.14, are interesting; naturally I am not prepared to argue on the subject as I am not in a position to do so, and it rather seems that the variant I mentioned with a tricycle undercarriage will be another of those queries of which aeronautical history is unfortunately so full. However, I *will* dispute the comment that the tricycle idea was not "seen even as a proverbial glint in any designer's eye." I enclose a cutting from my files (taken, I believe, from a pre-war issue of *Flight*), showing that the tricycle idea had at least been seen as a glint in the eye of a General Aircraft, Ltd., designer.

Grimsby, Lincs. P. H. T. GREEN.

[The cutting, from *Flight* of October 14th, 1937, shows a model of a G.A.L. project (four 900 h.p. Menasco B6-S engines, a.u.w. 13,000 lb, span 78ft, estimated cruising speed 150 m.p.h.). The original photograph is reproduced below.—ED.]

Consistent Winner

IN connection with the award of an R.Ae.C. Bronze Medal to Mr. Fred Dunkerley [see page 392—Ed.] perhaps we may be permitted a little space in which to say we consider that he has put up a really unique performance—and that we take no little pride in the fact that two Cirrus Minors assisted him and his Gemini to victory with such consistency.

The fact that with two 100 h.p. engines he averaged 174 m.p.h. in the *Daily Express* South Coast Race is a little out of the ordinary and his elbow-grease has certainly paid handsome dividends.

Whether it be a Gipsy or a Cirrus, one finds at race meetings that the power unit does not get its fair share of praise. Commentators always say "the Gemini did so-and-so" or "Dunkerley's just passed so-and-so" but the overworked mechanism trying to thrash itself to bits is ignored.

I, for one, certainly think that 174 m.p.h. is something to shout about, whether for Dunkerley's flying, his incessant polishing or our two tiny engines!

M. G. K. BYRNE,
Brough, Yorks. Blackburn and General Aircraft, Ltd.

Convertible Aircraft

THE writer was interested to note in the leading article, "Speeding the Helicopter," in *Flight* of March 28th, a reference to the fact that Capt. Liptrot is advocating convertible aircraft, i.e. aircraft combining a rotor (or rotors) and fixed wings in one air craft. In regard to *Flight's* own comment thereon—"Thus, we may next expect to see the marriage of the rotating-wing aircraft and the fixed-wing type"—if Capt. Liptrot (or any others interested) care to examine the aeronautical patent specifications in the Patent Office Library, he (or they) will find that the idea of convertible aircraft of this type is by no means new. The writer's own Patent No. 499632, covering this idea, was applied for on April 14th, 1938, and was followed by patents of addition thereto Nos. 568505 and 524913 in following years. Patent No. 499632 alone carries no fewer than 32 claims and is illustrated by 28 figures. These patents cover *basic* principles, not just merely means and methods of carrying into effect known basic principles, as is the case with probably 99.9 per cent of patents.

For the information of those of your readers who possess some knowledge of the technicalities of patent law, the writer would state that not one single citation was made by the Patent Office Examiner against any one of the 32 claims of No. 499632, which must constitute almost a record in patent procedure.

The patents in question have been kept in force, consequently they are still operative as such.

London, S.W.17. E. V. HAMMOND.

Flight Simulators

IN a very interesting article in *Flight* of March 9th, under the heading "Flight Simulator," the wording at the beginning of the second paragraph gave me the impression that B.O.A.C. was to have the first flight simulator ever built in Britain.

On this point I beg to differ—as usual the R.A.F. was first; in 1942, Air Chief Marshal Sir Arthur S. Barratt foresaw the possibilities outlined in your article, and, under his direct authority, flight simulators (very similar to the one you describe) were built and extensively used at St. Athan up to the end of the war.

Canterbury. F. WITTWER BARLING.

Prophet without a Clue

THE following paragraph, taken from the *Illustrated London News* of July 15th, 1854, may be of interest to readers as a comparison between the attitude of the Press to pioneers then and now:—

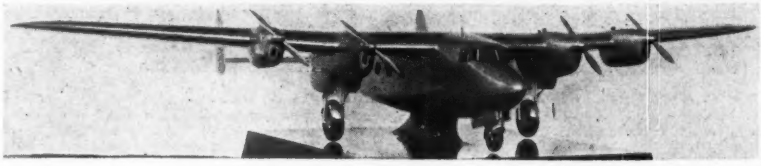
"The unfortunate Frenchman, Le Tour, whose so-called 'successful parachute descent' we noted last week, has died of the injuries he received in it; indeed, from the first he never rallied, his recovery was hopeless. An inquest has been held on his body, and a verdict of 'Accidental Death' returned. Some of the jury were for accompanying their verdict with a recommendation to the Home Secretary for the prevention of such stupid and reckless exhibitions in future; but they were restrained from it by the majority, who considered it might be 'prejudicial to the interests of science' to interfere.

"Now, the interests of science have nothing to do with ballooning or parachuting; the whole 'act' is an idle amusement got up to fill the pockets of unscrupulous speculators; and it is high time that it should be restrained within harmless bounds. The magistrates, some time back, interfered successfully to prevent the lives and limbs of ponies and donkeys from being imperilled in such tomfooleries—why should poor, stupid man go less regarded? Surely it would be easy to frame a power to prevent the announcement of 'feats' of this kind, which shall be shown to be very likely to terminate in disaster."

Twickenham, Middlesex. A. D. ROLES.

FORTHCOMING EVENTS

Apr.	6-10.	Physical Society: Exhibition, Imperial College, South Kensington, London, S.W.7.
Apr.	7.	British Interplanetary Society: "Evolution of Life in the Universe," by Prof. J. D. Bernal, F.R.S.
Apr.	10.	R.Ae.S. Section Lecture: "Simulators," by W. R. Thomas, B.Sc., A.M.I.E.E.
Apr.	12.	R.Ae.S.: "Comet Planning and Production Methods," by H. Povey, A.F.R.Ae.S.
Apr.	13.	College of Aeronautics, Cranfield: Senior Common Room, Society's Annual Dinner.
Apr.	13.	R.F.C. and R.N.A.S. Second Reunion.
Apr.	26.	R.Ae.S.: Discussion: "Air Travel from the Passenger's Point of View."
Apr.	26.	R.Ae.C. Film Show: *Flying Club*, 1925-50, film and commentary by A. Graham Head, and *Eagles of the Fleet*.
Apr.	28.	Exeter Aero Club Rally.
Apr.	29.	First International Helicopter Competition, Italy.
May	5-8.	Foire de Paris Rally, Toussus-le-Noble.
May	12-13.	Isle of Wight Air Races.
May	12-14.	Aero-Club de France: Champagne Rally.
May	13-14.	S.M.A.E. International Model Competitions.
May	14.	S.S.A.F.A.: Air Display, Hucknall, Notts.
May	19.	Derby Aero Club: "At Home" and Flying Display.
May	20.	Kent Coast Flying Club: "At Home" (sponsored by A.B.A.C.).
May	26.	Newcastle-on-Tyne Air Display.
May	26.	Wolverhampton Aero Club: "At Home" and Goodyear Trophy Race.
June	2-4.	Yorkshire Aeroplane Club: International Rally.
June	8-10.	Air Circuit of Sicily.
June	9.	Rally and Race, Fairwood Common Aerodrome, Swansea.
June	10.	Lancashire Aero Club: "At Home" (sponsored by A.B.A.C.).



The 1937 General Aircraft, Ltd., project for a four-engined, retractable-undercarriage, 12-seat transport, referred to in the letter, above, from Mr. P. H. T. Green

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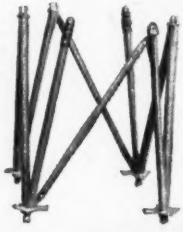
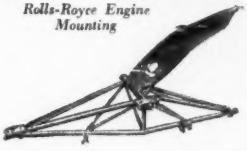
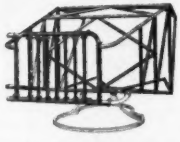
Mamba Engine Mounting



Bristol Centaurus Ring

Rolls-Royce Engine Mounting





A light steel tubular structure produced for Messrs. Armstrong Siddeley Motors Ltd. for de-icing tests on a 'Mamba'-engined Lancaster

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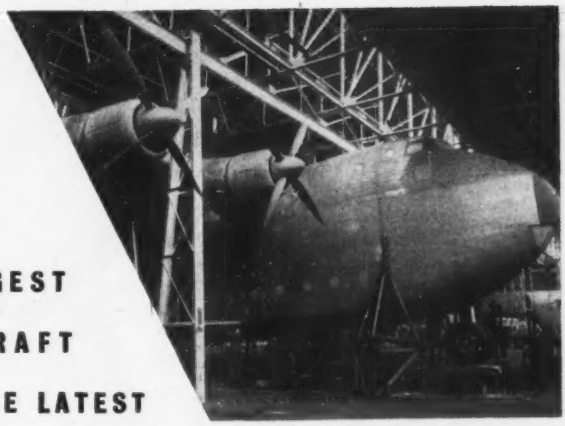

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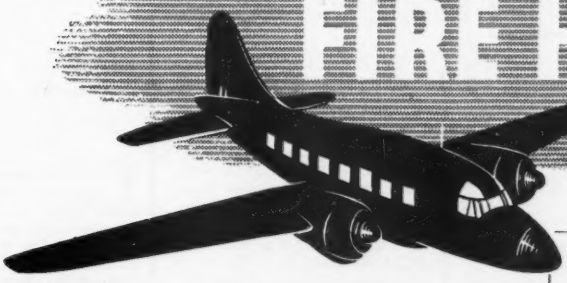

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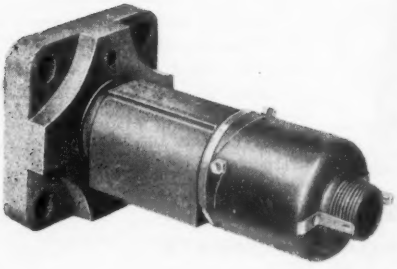

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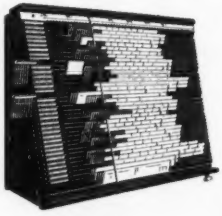

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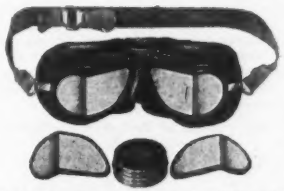

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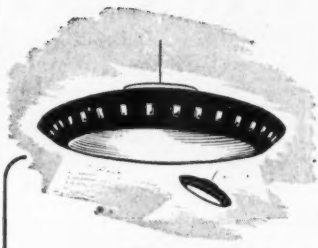

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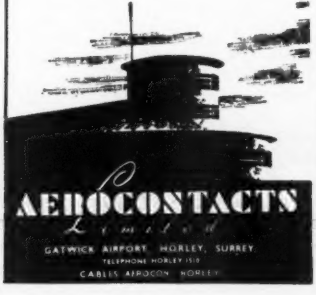

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83 GROUP (R.A.F.) Officers' Association.

AN all ranks re-union will be held in London on Friday, April 7th. Tickets, 5/- (exclusive) and further details may be obtained from F. S. Berry, 11, Bush Hill Road, N.21. [0094

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THE "ultra lights." Solo flying on Dart Kitten and Slingsby Motor Tutor now available to licensed pilots at £1/10/- per hour. [0332

SITUATIONS VACANT

ROYAL NAVY.

COMMISSIONS IN THE INSTRUCTOR BRANCH.

APPLICATIONS are invited from University graduates and qualified teachers under 26 years of age for commissions in the Instructor Branch, Royal Navy.

1. REQUIREMENTS are mainly for officers with qualifications in mathematics science (physics, chemistry or metallurgy) or engineering, but a few vacancies exist for officers with degrees in English, history, geography or economics with a sound mathematics or science background.

2. COMMISSIONS will be granted for periods of 3, 4 or 5 years, and, after 2 years' service, opportunities will be afforded for officers to be transferred to the Permanent List. A Short Service engagement in the Instructor Branch will discharge any candidate's obligation under the National Service Acts.

3. Entry will be in two grades. Selected candidates with 1st or 2nd class Honours Degrees receive approximately £410 in their first year's service, £429 in second year, £547 in third and fourth years, £584 in fifth year. Other candidates receive £319 in first year, £362 in second and third years, £429 in fourth and fifth years. Previous officer service in the recent war will be recognised for adjustment of seniority and rate of pay on entry. Accommodation and rations are provided or allowances in lieu. Married officers if aged 25 or over normally receive marriage allowance of £338 per annum, if not accommodated in official married quarters, £283 per annum if they are accommodated and £146 per annum in either case if under 25. An initial Outfit Allowance of £103 is paid, together with a free issue of certain articles of clothing. A reduced allowance is payable to candidates with previous Naval Service as officers. Tax free gratuities of £300, £400 or £500 are payable at the end of 3, 4 or 5 years respectively.

4. Instructor officers serve both ashore and afloat and their duties include both technical instruction and general education. Officers with suitable qualifications may also be trained and appointed for full or part-time meteorological and weather forecasting duties.

5. Service in the Instructor Branch will, if desired, be treated as contributory service under the Teachers' (Superannuation) Acts, superannuation contributions being deducted from the above gratuities.

6. Apply to Director (P), Education Department, Admiralty, London, S.W.1, for fuller details and application forms. [6108

APPLICATIONS are invited for the following positions in the London area:

DEVELOPMENT engineers required for manufacturers of a.c. and d.c. electrical equipment for aircraft. Applicants should hold at least a Higher National Certificate or preferably an engineering degree. The positions are superannuated and give considerable scope to men with adequate experience.—Write, giving full details in strictest confidence, to the Employment Officer, Rotax, Ltd., Chandos Rd., Willesden Junction, N.W.10. [6063

APPLICATIONS are invited for the following positions in the London area:

DRAUGHTSMEN required for detail drawing of experimental designs of aircraft electrical equipment. Works experience essential.—Write, giving full details in strictest confidence, to the Employment Officer, Rotax, Ltd., Chandos Rd., Willesden Junction, N.W.10. [6064

VACANCIES exist at Blackbushe Airport for storekeeper, fitter engine, fitter airframe.

APPLICATIONS to: Manager, Silver City Airways Ltd. [6084

BRITISH EUROPEAN AIRWAYS have vacancies for pilots with the minimum qualification of a current commercial pilot's licence:

(a) Pilots, aged 34 years and under, who will be engaged under the normal conditions of service, which includes membership of the pension scheme. Commencing salary on engagement will be within the range £800-£750 p.a., according to qualifications and experience.

(b) Pilots, aged 35 years and over, who will be engaged under special conditions on a temporary appointment for a period of service of two years, with the possibility of extension. Commencing salary on engagement will be within the range £900-£800 p.a., according to qualifications and experience. Pilots serving on these appointments will not be eligible for entry into the pension scheme, but will receive a gratuity on the termination of the appointment for each completed year of service, subject to completing at least one full year's service.

REQUESTS for application forms, stating whether (a) or (b) appointments are being applied for, to be made by postcard to the Personnel Officer, Flying Operations Department, B.E.A., Keyline House, Ruislip, Middlesex. [6058

COMMERCIAL pilot required to fly Auster, Gemini and Rapide aircraft.—Apply by letter to The Manager, Isle of Wight Airport, Sandown, I.o.W. [6091

AIRCRAFT stressmen required.—Write, stating qualifications and experience to Employment Manager, Vickers-Armstrongs Ltd. (Aircraft Section) Weybridge. [6095

APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrove, Edgware, Middx. [6075

SENIOR aircraft estimators required.—Write, stating experience and qualifications, to Employment Manager, Vickers-Armstrongs Ltd. (Aircraft Section), Weybridge. [6096

QUALIFIED flying instructors, ex-R.A.F.; also staff pilots for Anson XIX aircraft required for 15 Reserve Flying School, Redhill.—Apply, giving full particulars, age, qualifications, etc., to Chief Instructor. [6089

VACANCIES on permanent staff for senior and junior pilots—good pay and conditions.—Write, stating details of experience and qualifications.—Air Navigation, Ltd., Squires Gate, Blackpool. [6087

AIR ENTERPRISES Ltd. require urgently at their Renfrew Base two radio officers holding first-class flight radio telegraphy licence. Agreed rates of pay and conditions of employment, plus flying bonus.

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QUALIFIED flying instructor for ground lecture duties up to instrument rating standard.—Apply: Chief Instructor No. 26 Reserve Flying School, Municipal Aerodrome, Wolverhampton. [6078

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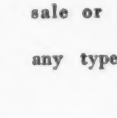

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MINISTRY OF CIVIL AVIATION.

APPLICATIONS are invited for at least ten posts of air traffic control officers, Grade III. Further vacancies which occur during the next year may also be filled from the candidates who qualify at this competition. Candidates must be at least 23 and under 35 years of age on February 1st, 1951. Essential qualifications are alertness, good personality, physical fitness, tact and balanced judgment. Applicants must have passed the matriculation examination of a British University or produce evidence of having reached a comparable standard of general education. They must have had experience (i) as a pilot or navigator in civil aviation, or (ii) in other service on the operational side of a civil aviation organisation, or (iii) in air traffic control in the Armed Forces combined with experience as a pilot or navigator. Additional assets will be general knowledge of civil aviation legislation and practice and of radio and radar aids to navigation, and a working knowledge of the French language. Air traffic control officers are required to serve anywhere in the United Kingdom and are liable to tours of duty overseas. Rates of pay range from £360 per annum at age 23 to £540 per annum at age 29 or over, on entry, rising by annual increments to £750 per annum. (London rates, subject to deductions from £10 to £30 for posts outside the London area.) Posts are unestablished, but have long-term possibilities.—Apply to the Ministry of Civil Aviation, Room 310A, Woburn Place, London, W.C.1, for application forms and further particulars, quoting reference Est 1a/ATCO. The latest date for receipt of completed applications is May 3rd, 1951. Applications from overseas may be by letter in the first instance, giving date of birth and full details of qualifications and experience. [6107

JIG and tool draughtsmen required, fully experienced.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [6093

PILOT required for contract work with a minimum of 1,000 hours on fighter-type aircraft. Apply in writing, stating age and full details of experience to Box 0692. [6103

RESERVE SCHOOL require flying, navigation, link instructors, and air traffic controller. All with R.A.F. categories. Details to Manager, No. 9 R.F.S., Ellers Road, Doncaster. [6104

SENIOR DRAUGHTSMEN required, aircraft experience desirable but not essential. Living accommodation available.—Apply, Personnel Officer, Essex Aero Ltd., Gravesend, Kent. [6106

DRAUGHTSMEN with good aeronautical (or mechanical) experience, and stressmen with aeronautical experience required for interesting work.—Apply Fortsmouth Aviation Developments, The Airport, Portsmouth. [5952

AIRSPEED, Ltd., Christchurch, have vacancies for aerodynamicists, preferably with experience of performance and/or stability and control. Superannuation scheme; hostel accommodation available; flying club in district. [6056

AIRSPEED, Ltd., Christchurch, have vacancies for aircraft draughtsmen with radio installation experience.—Particulars in writing, stating training, past experience, and salary required, to Staff Superintendent, Airspeed, Ltd., Christchurch, Hampshire. [6057

AIRCRAFT estimator required; good all-round experience and ability to work from drawings essential.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [6092

MECHANICAL, structural or general engineering draughtsmen wanted for aircraft work; previous aircraft experience not essential; pension and life assurance scheme.—Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6060

HANDLEY PAGE, Ltd., have a vacancy for a technical illustrator with previous experience in aircraft work.—Write, stating age and full details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [6003

EXPERIENCED male technical illustrator and several experienced tracers required; must be neat and quick.—Apply in writing, stating age, experience and salary required, to the Chief Designer, Auster Aircraft, Ltd., Rearsby Aerodrome near Leicester. [6005

FLYING instructors required by two West Country flying clubs. Applicants must possess full instructor's endorsement A commercial pilot's licence.—Apply, giving full particulars of previous experience to Box 6666. [6097

STRESSMEN required for interesting work in connection with aircraft construction.—Write, stating age, experience, qualifications and salary required, to Mr. E. G. Collinson, Chief Technician, British Messier Ltd., Cheltenham Road East, Gloucester. [6074

DESIGN DRAUGHTSMAN (SENIOR), experienced in instrument design, required by large light engineering company east London district. Apply, in writing, giving age, previous experience, and salary required, to Box 7690. [6100

SCOTTISH AIRLINES require at once first officers and radio officers, D.C.3 experience an advantage. Write, stating full details of licences and experience to: Personnel Manager, Scottish Airlines, Prestwick Airport, Ayrshire. [6105

DRAUGHTSMEN will find interesting work on aircraft undercarriages and hydraulic components with progressive company.—Apply in writing, stating age, qualifications, details of experience and salary required, to the Chief Draughtsman, British Messier, Ltd., Cheltenham Road East, Gloucester. [6040

BROOKLANDS AVIATION, Ltd., have vacancies for airframe and engine fitters, electricians and woodworkers for servicing and repair of R.A.F. and R.N. aircraft. Good conditions, interesting work, piecework bonus.—Apply: No. 4 Site, Bywell Aerodrome, Northampton. [6060

THE DE HAVILLAND AIRCRAFT Co., Ltd., have vacancies for senior design and intermediate draughtsmen (preferably with aircraft experience) in their Hatfield and London (Regent Street) offices.—Applications, stating age, experience and salary required, to Chief Draughtsman, de Havilland Aircraft Co., Ltd., Hatfield, Herts. [5919

A. V. ROE & Co., Ltd., have vacancies at Woodford Aerodrome, Cheshire, for senior and junior technical assistants with science degree or Higher National Certificate. Applicants should also have a good engineering background with previous experience in one or more of the following subjects:

HEAT transfer. De-icing. Aerodynamics. Fuel systems. Pressurisation. Hydraulics. Engine installations.

APPLICATIONS, stating age, qualifications, experience, also salary required, to Labour Manager, A. V. Roe and Co., Ltd., Greengate, Middleton, Manchester. [6086

TECHNICAL illustrators, artists or draughtsmen: fully capable of making perspective drawings of aircraft parts, systems, etc., in line for reproduction. Familiarity with engineering drawings is essential. Pension scheme. —Apply in writing to Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middx. [6053

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(5) Production clerk—able to arrange and progress printing and issue of publications. Will be required to segregate costs and supervise stocks and filing of returned art work and blocks, etc.
WRITE, giving full details of experience and quoting ref. 486, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [6109

A LEADING aircraft manufacturing company in the south of England invites applications for the appointment of a senior design executive.—Box 0792. [6110

DEVELOPMENT engineer required preferably of degree standard, for work connected with welding development on gas turbines in East Lancashire area, including the development of mechanical devices for automatic fusion welding processes.—Write, stating age and full details to Box 0793. [6111

NAVIGATORS. The de Havilland Aircraft Company, No. 1 R.F.S. Panshanger, have vacancies for navigation instructors with navigator's licence or R.A.F. flight navigator's experience.—Applications, with full details of experience, qualifications and age to Personnel Manager, The de Havilland Aircraft Co., Ltd., Hatfield. [6079

APPRENTICE supervisor required. Applicants must have served an engineering apprenticeship, possess administrative ability and have had some instructional experience. National Certificate the minimum education standard accepted.—Write, stating age, experience, qualifications and salary required, to The Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Luton, Beds. [0593

AIRWORK Ltd. require maintenance test pilots. Applicants should have a wide experience of both single and twin-engined aircraft also jets and preferably be in the possession of a current instrument rating. An indoctrination course will be arranged for suitable applicants.—Write, giving full particulars of experience, etc., to Airwork Ltd., Sutton Lane, Langley, Bucks. Envelopes to be marked "Flying Training." [6072

DRAUGHTSMEN with experience in the design of automobile and aircraft accessories, or of hydraulic equipment, are required by progressive Midland manufacturing company. The positions are permanent and offer special attractions to younger men. Salaries in excess of usual rates will be paid to those possessing good experience and qualifications. State full details of training and experience, age and salary required.—Box 0189. [5970

HANDLEY PAGE (READING), Ltd., have vacancies in their design office for senior and junior draughtsmen with aircraft experience. Also required are stressmen who should have at least two years' experience and with a degree or Higher National Certificate with endorsements in aeronautical subjects. These positions are progressive and offer excellent opportunities to the right men.—Please send full particulars to the Personnel Office, Handley Page (Readi..g), Ltd., The Aerodrome, Woodley, Reading. [0801

ASSISTANT required in business office of company situated in North West London area. Knowledge of sales organisation applying to Government contracts and aero engines and Air Ministry spare parts procedure. Accuracy at figures essential.—Apply, stating age, experience and salary required, to Box 0647 [6073

GAS dynamicist required. A degree in engineering and desirable and experience in the estimation of gas turbine performance and proportions essential. Progressive salary according to qualifications.—Apply, in writing, giving full particulars of career o, The Personnel Officer, Sir George Godfrey & Partners, Ltd., Hampton Road, Hanworth, Middlesex. [6075

STRESS CALCULATOR: experienced man required by aircraft engineers in Midlands. Must hold Higher National Cert. or equivalent qualifications. Excellent prospects for keen and competent man. State fully details of experience and qualifications, age and salary required to Box 0691. [6101

ENGLISH ELECTRIC invite applications from all grades of draughtsmen to work on an interesting new project in the Acton, London, aircraft drawing office. These positions are permanent and pensionable.—Those wishing to apply should write, quoting ref. 149A, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [6061

EXPERIENCED senior draughtsmen and stressmen required for interesting new work. Applicants should hold the Higher National Certificate in engineering. Junior weight estimator also required.—Applicants for all posts should apply in writing, stating age, experience and salary expected, to the Chief Designer, Auster Aircraft, Ltd., Rearsby Leics. [5991

APPLICATIONS are invited from senior and intermediate design draughtsmen: experience of aero engine design desirable but not essential.—Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0449

DOWTY EQUIPMENT, Ltd., Aircraft Hydraulic Engineers, Arle Court, Cheltenham, require design draughtsmen, preferably with some knowledge of hydraulic and landing gear components for aircraft.—Write, Personnel Manager, giving details of training and experience and mentioning age and salary range. [0942

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers; detail and modification draughtsmen; checkers; stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft. Hobson Works, Fordhouses, Wolverhampton. [6102

AIRWORK, Ltd. urgently require navigation instructors for air and ground duties. Desirable qualifications staff navigator course and instructing experience. Applicants must be prepared to obtain Flight Navigators Licences. Write, giving full particulars to the Chief Instructor, R.A.F. Station, Usworth, Near Newcastle, Co. Durham. [6096

HANDLEY PAGE (READING), Ltd., have vacancies in their design office for stressmen who should have at least two years' experience and with qualifications up to A.F.R., Ae.S. or B.Sc. standard; these vacancies carry excellent prospects for the right men.—Send full particulars to the Personnel Officer, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0574

HANDLEY PAGE Ltd. have vacancies for senior and junior technical assistants in the mechanical and structural test department at Radlett or Cricklewood. Qualifications should include a degree or Higher National Certificate. Previous experience is desirable but not essential.—Write, stating age, qualifications and details of experience to, Staff Officer, Handley Page Ltd., Cricklewood, London, N.W.2. [6080

SENIOR aerodynamicists required for work on high-performance aircraft: applicants should have an engineering degree and experience in design of controls, performance calculations and estimation of aerodynamic loads.—Write, giving particulars of age, experience and salary required, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0686

BRITISH EUROPEAN AIRWAYS have vacancies for engine and airframe fitters, radio mechanics, electricians and instrument repairers for shift work at Northolt and London Airports. Experience in Dakota and Viking aircraft and possession of current maintenance engineer's licences would be an advantage. Hourly rate 2/10 plus 4½d. lieu bonus plus up to 3d. proficiency pay, Pension, insurance and sick pay schemes; two weeks' paid holiday a year; air travel concessions.—Applications, in writing, to Personnel Officer, Northolt Station, B.E.A., Ruislip, Middlesex. [0695

BRITISH EUROPEAN AIRWAYS have vacancies at Northolt for draughtsmen. (a) Senior, with Higher National Certificate and aircraft workshop and drawing office experience; (b) Intermediate, with Ordinary National Certificate, 2 years' workshop and 2 years' aircraft drawing office experience. Minimum weekly pay £5/6/0 at age 21 to £9/6/0 at age 25. Additional proficiency pay according to qualifications. Pension and sick pay schemes, 3 weeks' holiday with pay a year, air travel concessions.—Applications to Personnel Manager, B.E.A., Keyline House, Ruislip, Middlesex. [6091

BRITISH OVERSEAS AIRWAYS Corporation offer opportunities of work on modern airliners to the following tradesmen: electricians, instrument mechanics and radio mechanics, sheet metal workers, engine and airframe fitters experienced in the maintenance or overhaul of aircraft and/or components. Rates of pay, 2/4½ per hour, plus 4½d. per hour provisional bonus. Attracting proficiency pay up to 3d. per hour, five-day, 44-hour week; possible shift work. Good pension, sick pay and holiday facilities.—Write or call, Staff Manager, Hut 29, London Airport, Feltham, Middlesex. [0909

DESIGNERS and draughtsmen required for special project with experience on aero or automobile engine design and/or hydraulic valves and equipment, combustion and fuel control. Higher National Certificate standard. Draughtsman also required on design of engine test bed equipment. Man with experience on the design of hydraulic valves, pumps and other equipment associated with test bed design. Permanent positions offered in connection with all the above mentioned vacancies to right type of applicants, and housing accommodation available to approved staff in the late autumn.—Please write, stating age, experience and salary required (quoting reference E.D.), to Box 0493. [6045

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Illustration on left shows length of cargo in relation to Freighter hold.

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